THE
ELECTRICAL REVIEW.

VOL. XLVII. NOVEMBER 9, 1900. No. 1,198.

CONTENTS:

	PAGE
Continental Steam Engine Practice	729
Smoke Abatement	730
The Inductance of Concentric Cables (*illustrated*)	731
A Comparison of English and American Practice in Cable Manufacture	732
Deaths from Electric Shock	733
Current Specifications.—XXXV.	734
Correspondence:—	
Proposed Electrical Contractors' Association	735
Comparative Cost of 100-volt and 200-volt Supply ...	735
Transformers for Cable Testing (*illustrated*)	736
Legal	736
The Responsibilities of Town Councillors	737
Business Notes	738
Electric Tramways in Sydney (N.S.W.) (*illustrated*)	745
Cutting Structural Iron by Means of the Electric Arc ...	747
Electrical Plant at the Sneyd Colliery (*illustrated*)	749
The Burgdorf-Thun Polyphase Electric Railway (*illustrated*) (*concluded*)	752
Electrical Engineers R.E. Volunteers (*illustrated*)	753
Supply Station Accounts	757
City Notes	758
Traffic Receipts	760
Stocks and Shares	760
Share List of Electrical Companies	761
Market Quotations	762
Metal Market.—Fluctuations in October	763
Electric Tramways at Grimsby and Cleethorpes	763
Recent American Steam Engine Practice	763
The Synchronisation of Alternators Coupled in Parallel (*illus.*) (*continued*)	764
The Niclausse Water-Tube Boiler	765
The Compulsory Supply of Electricity	765
The Unions of State Employés	766
Our Legal Query Column	767
New Patents	767
Abstracts of Published Specifications	768

THE
UNIVERSAL ELECTRICAL DIRECTORY
1900
Edition.
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.
OFFICE:—4, LUDGATE HILL, LONDON, E.C.
Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone No. 933 Holborn.
ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.
ADVERTISEMENT RATES ON APPLICATION.
The "Electrical Review" is the recognised medium of the Electrical Trades.

SUBSCRIPTION RATES.—In Great Britain, Post Free per Year, 19s. 6d. To all other countries, per Year, £1 10s.
BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.
CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each.
READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can now be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.
FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. Paris: VEUVE J. BOYVEAU, 22, Rue de la Banque. Berlin: ASHER & Co., 13, Unter den Linden.
Cheques and Postal Orders (on Chief Office, London), to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

CONTINENTAL STEAM ENGINE PRACTICE.

AN article in a technical contemporary by Mr. Wansbrough on the machinery at the Paris Exhibition is sub-titled "Some British Observations at the Paris Exhibition," and deals with the engines in the various exhibits. The great glory of the steam engines at Paris is their paint. We fully agree with Mr. Wansbrough that all the foreign steam engines, except the blood-coloured one from Belgium, are better finished in dull black than the mere shop-painted engines from England, but we notice that the writer omits to state that the only engines which, throughout, have satisfactorily dispensed electricity to the big show, have been the British engines, and on one occasion, at least, all the engines were *hors de combat* except the British, on which the whole Exhibition for a time depended. We cannot, however, follow Mr. Wansbrough when he waxes enthusiastic over nickel plate, that tawdry decoration that ought never to be allowed on any piece of ironwork. But the author points out some things which may account for the Continental engines having failed to give the continuous running of English engines. Foremost amongst these are the Continental valve gears; it would be wrong to say that all are bad or complicated, yet we ourselves certainly did see at Paris some valve gears that were examples of what to avoid. They are cited by Mr. Wansbrough as an evidence of the vain seeking after a sharply defined cut-off corner on the diagram, which is as useless as it is expensive. It is unfortunate that the Corliss valve gave a good cylinder drainage so long before the general engineer realised the effect of good drainage, for the economy secured was attributed to the sharp corner given by the valve gear.

We agree that Mr. Wansbrough is right in excepting the Collmann gear from adverse criticism. It is the Lefer gear that comes in for his severest censure. Most of the engines, outside France, have double-beat valves, some of which are quiet, many of which are noisy, but Van der Kerchove, of Ghent, suppresses valve seats altogether, and fits instead perforated or ported cylindrical liners, inside which rise and fall ordinary piston valves. There is no stop to the fall of the valve, that is, no defined stop, and the motion allowed is twice that of double-beat valves. The simplest valve gear in the whole Exhibition is that on Robey's compound horizontal engine—the Richardson-Rowland trip gear; while a French engine—the 1,300-H.P. engine of Farcot—has plain Corliss gear. The 1,200-H.P. engine of the Fives-Lille Company is said to have a crew of five or six men to drive it, and we do not consider this too many for the amount of mechanism involved. From the illustrations given, there appear to be some very bad Continental designs of fly-wheels and cross-heads, which show that all are not yet superior to our own productions, while

D

there is much in the design that is bad in point of convenience.

But apart from garish nickel, the finish of some of the Continental engines in dull black, and with Russian iron cylinder lagging, is really excellent. The dull black upon already smoothed and filled castings does not show up the irregularity of surface as does a bright oil paint. The question remains: Does such high-class painting befit a steam engine? It is at least satisfactory to know of the unique behaviour of the English engines, in alone standing up to their work.

SMOKE ABATEMENT.

One of the earliest recollections we have upon the smoke question is that of two Lancashire cotton spinners—uncle and nephew—looking at their respective factory chimneys and contending as to which had precedence in smoke production, the point of pride being the possession of the chimney throwing out the blackest volume. Matters have improved to-day, but not so very much, nor is the question of smoke prevention much better understood than it was by Wye Williams 40 years ago. The wants of the community in the time of King Edward I. cannot have been very great when we read that the use of sea coal, as Northumberland coal was called, was prohibited on pain of death. We can hardly agree with the statement of Mr. W. H. Bryan, in an engineering exchange, that much progress has been made in smoke prevention. It seems to us that the greatest item is still neglected—that of the necessary temperature of ignition. Furnaces to-day are furnished with devices for air admission above the fuel, and perhaps the area allowed is a little greater than it was, but the principle was understood years ago; moreover, engineering professors have been known to state that no heat could be got out of the hydro-carbons of bituminous fuel, but, as scientific teachers, they should have pointed out that bituminous coal could not be burned smokelessly in a water-cooled furnace. We have lately called attention to certain water-tube boilers in which the principle of lining furnaces with firebrick has been accepted, but generally the water-tube boiler has been a smoker, and many engineers who have no good word for any boiler except the water-tube, have grumbled at bituminous coal, whereas, as engineers, it ought to be their aim to utilise the forces and products of nature for the use and benefit of man. Their objection or inability to do this has placed them in a position of obligatory beggars upon Welsh coal merchants, or defendants in the police courts in smoke prosecution cases, as to which latter it has been suggested that the economy of bituminous coal is such that it is cheaper to burn it and pay fines than to order smokeless Welsh. Smoke is a nuisance, though its prevention has become too often the hobby of faddists. There are all sorts of devices for admitting air to furnaces at the time when gas is being driven off the fuel, but these are of very little use unless the furnace is such as to prevent premature cooling of the gases. Though not perhaps very clear at first sight, it is this that makes it necessary to admit so very much air; for this reason we hear of the unavoidable loss due to smoke prevention, whereas with sufficient draught, thick fires, and well-regulated air admission an economy would be realised. In respect of draughts, the Americans appear to be moving ahead of ourselves. They often use fans. Here, where there is such a tendency to cut down capital expenditure, this obvious capital economy is practically neglected. We need not follow Mr. Bryan in his descriptions of various appliances, because the matter is so much one of principle, and it ought to be recognised as such. Perhaps we may not live to see it, but unless power and heat are distributed electrically or by steam or hot water from some large central plant, we may expect in time to find all fires discharging into a common flue with a distant outlet.

We are quite prepared to admit that if it is properly carried out, there is some economy to be effected by preventing smoke, but it is asking too much when Sir W. B. Richmond talks about compelling factory owners to save 25 per cent. in fuel which they now wantonly waste. Half the fuel burned is wasted, but it is not wasted in smoke, but in boiler inefficiency and excessive air supply, and one of the difficulties of smoke prevention is generally thought to be the want of radiating power of the transparent gases. More to the point is the letter of the President of the Smoke Abatement Society to the *Times*. He writes that 18 million tons of coal are annually consumed in London, and he considers that two-thirds is wasted in heat up the chimneys; a loss of £8,000,000 is thus endured annually, apart from the £3,000,000 for damaged furniture and paint. He estimates a total annual loss of £12,000,000. Much of this could be saved by more perfect combustion of fuel in central stations. It is a pity that producer gas is so very dangerous as a poison, but we cannot see why it should not be largely employed as our general heating agent, while the heat produced when it is made could be used to heat water for distribution within a reasonable radius of the producer. Unfortunately, producer gas, being largely carbon monoxide, cannot be conveyed in cast-iron pipes. It is a pity that smoke prevention people cannot keep their statements within the realm of fact, and avoid mis-statements and exaggerations.

Institution of Electrical Engineers (Glasgow Local Section).—Mr. E. G. Tidd, the hon. secretary of this section, has been sending out the local sessional card, showing the dates of meetings. The opening meeting is to be held on Wednesday, November 14th, at 8 p.m., when a paper on "Electrical Supply" will be read by Mr. W. A. Chamen, Corporation electrical engineer of Glasgow. The Committee has secured the smaller hall in the Institution of Engineers' and Shipbuilders' Building, at 207, Bath Street, for the meetings. We are glad to learn that already sufficient papers have been promised to provide important and interesting discussions for the whole of the session.

The Faradian Club.—To-night the smoking concert of this club is to be held at the St. James's Restaurant (Regent Saloon), Regent Street, W. At 8 p.m. Mr. Robert Hammond will take the chair. Also in connection with the club there is to be a lecture at Faraday House on November 30th at 8 p.m. by Prof. C. A. Carus-Wilson, M.A., on "Swiss Polyphase Railways," while on December 10th Mr. J. S. Raworth, M.I.C.E., will lecture on "The Modern Steam Engine." The club dinner will be held at the Hotel Florence on December 14th.

THE INDUCTANCE OF CONCENTRIC CABLES.

By W. H. EVERETT, A.M.I.E.E.

The absence of an external field in the case of concentric cables is, perhaps, apt to give rise to the idea that they have no inductance. It is true that there is practically no inductive effect on the outer conductor, but the interior field is not always negligible, as will be seen from the results given below.

To calculate the inductance, we use the definition that the inductance is equal to twice the energy in the magnetic field due to unit current. The energy per unit volume can be shown to be $\mu H^2/8\pi$ (if the permeability μ is assumed to be constant), and hence, if H is known for all parts of the field, the total energy may be found by integration. In concentric cables the permeability is unity, except in the armouring, if this is used; and since H is zero outside the outer conductor, the armouring does not affect the inductance.

In a simple concentric cable, in which the outer conductor acts as return for the inner, there is no outside field, since the resultant current is zero. Between the two conductors, and also within the inner, there is only the field due to the inner, for the outer gives no internal field. The field between, for unit current, is $2/r$, where r is distance from centre. Within the inner the field is $2r/a^2$, if a is the radius. Writing b for the radius of the outer, we find by integration that

$$L = 2 \log_e \frac{b}{a} + \tfrac{1}{2},$$

in C.G.S. units per centimetre.*

The first term, arising from the field in the intervening dielectric, depends only on the *ratio* of the radii; the second term, due to the field within the inner conductor, is obviously independent of its radius. If the inner is a thin tube, instead of a solid conductor (as, *e.g.*, in the Deptford mains approximately), the second term is zero. Also, a diminution in the second term will be caused by any concentration of the current in the inner towards the periphery.

The smallest value of L, if we assume now a solid inner, is $\frac{1}{4}$, viz., when the dielectric is of negligible thickness. In a cable for high pressures b/a may reach the value 3, or thereabouts, giving $L = 3$ say.

It is interesting to note that the inductance takes effect on the inner conductor only, so that if the two conductors are of equal section there will be a slightly greater total drop of pressure in the inner.

The inductance will be most noticeable in a cable of large section, because the current will be large, while the drop due to resistance with a given current density will be the same as in smaller cables. Take the case of a cable carrying 1,000 amperes; assuming the dimensions of the section to give $L = 1$, we find for the voltage drop per kilometre, with $n = 50$,

$$v = 2\pi n L C l = \text{say } 300 \times 1 \times 1{,}000 \times 10^5/10^9 = 30 \text{ volts.}$$

This would be about the same as the ohmic drop in the above case. In a cable for 100 amperes the inductive drop, with $L = 1$, would be only about one-tenth of the ohmic drop.

The inductance of a concentric cable will practically in all cases be less than that of a pair of separate cables. The formula for the latter case is:

$$L = 4 \log_e \frac{d}{a} + 1, \text{ per cm., in C.G.S. units,}$$

where d = distance between centres, and a = radius of each. The smallest value for L occurs when the conductors are nearly in contact, or $d = 2a$, giving $L = 3{\cdot}77$. An ordinary value in practice would be $L = 5$, say, while ordinary values for concentrics are $L = 1$ or 2. Concentrics have the additional advantage that their inductance is unaffected by armouring.

* This formula is given in Prof. J. J. Thomson's "Elements of the Mathematical Theory of Electricity and Magnetism."

Triple concentric cables are used both for three-wire single-phase and also for three-phase* alternating currents. In the former case the outer is preferably the neutral, and is usually of smaller section than the two inner conductors, since it has only to carry the difference of their currents. By similar reasoning to that used in the simpler case above, we find that the inductance consists of three terms: there are two terms, as before, affecting the current in the innermost conductor, viz., $2 \log \frac{b}{a} + \frac{1}{2}$. (By a, b, c, we denote the inner, middle, and the outer radii.) In addition, there is a term $2 \log \frac{c}{b}$, for the interval between the middle and outer. The field in this part depends only on the difference of the two inner currents, and this term of the inductance will tend to reduce that difference. The effect will take place mainly on the current in the middle conductor, the inner being partly shielded by it. This effect will tend to interfere with good balancing.

To get an idea of the value of the lost pressure due to inequality of the two inner currents, assume the difference to be 100 amperes, and let $c/b = 5/4$, or $2 \log c/b = \frac{1}{2}$ nearly.

The volts lost per kilometre, if $n = 50$, will be

$$v = 2\pi n L C l = \text{say } 300 \times \tfrac{1}{2} \times 100 \times 10^5/10^9 = 1\tfrac{1}{2} \text{ volts.}$$

The effect is, therefore, almost inappreciable, especially as the inductive pressure is in quadrature with the currents.

In a triple-concentric cable carrying three-phase currents, since the sum of the currents at any instant, taken in either direction, is zero, it follows that there is no external field. Within the intermediate conductor we have a field due to the inner current, giving the inductance $2 \log b/a + \frac{1}{2}$, as before.

Fig. 1.

Fig. 2.

Between the middle and outer there is a field due to the algebraical sum of the currents in the inner and middle at each instant. If we write one as $C \sin \theta$, the other is $C \sin (\theta - 120°)$, and their sum is $C \sin \theta + C \sin (\theta - 120°)$, which reduces to $C \sin (\theta - 60°)$.

This represents a current of the same amplitude as each component and intermediate in phase; as is also obvious otherwise. Since the back E.M.F. due to this lags 90°, its

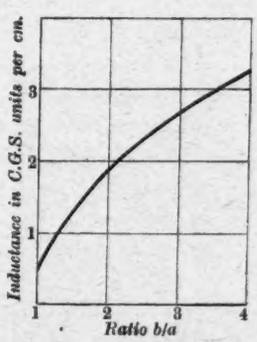


Fig. 3.

phase angle is $\theta - 150°$; and the component of applied E.M.F. required to overcome this has a phase angle of 30°.

Take $c/b = 5/4$, and $p = 300$, as before, and we have the reactance,

$$L p = 2 \times 10^5 \log \tfrac{5}{4} \times p = 0{\cdot}015 \text{ per km., roughly.}$$

* Three-core cables are preferred for three-phase current.—Eds. Elec. Rev.

The resistance per km. is about 0·05 for a conductor of section 0·5 square inch. By combining the reactance and the resistance, we find the impedance of the intermediate conductor, as shown in figs. 1 and 2. The angle between the vectors representing L p and R is 30° in fig. 1 and 150° in fig. 2, as follows from the previous reasoning. The middle conductor will shield the inner to a great extent from the inductive action, and we shall assume that the whole effect takes place on the middle conductor. With this approximate assumption, it will be seen from the diagrams that in the

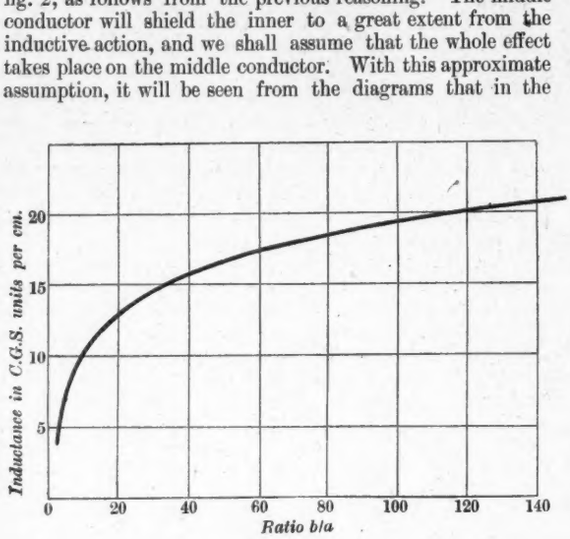


Fig. 4.

cable considered—viz., a triple-concentric cable carrying three-phase currents, each conductor having a section of 0·5 square inch—the voltage drop in the intermediate conductor may be increased 20 per cent. or so, if its current is in advance of the inner current as regards phase, and on the other hand, the drop will be decreased if the phase relationship of the two currents is reversed. This point may be worth bearing in mind when connecting up the mains to the bus bars.

In order to facilitate the application of the formulæ, a curve is given (fig. 3) showing the value of $2 \log_e b/a + \frac{1}{2}$ in terms of b/a. For comparison, a similar curve is given (fig. 4) for finding the inductance of a pair of separate parallel cables: the ordinates are the values of $4 \log_e b/a + 1$. The range of both curves is sufficient to include all cases likely to arise in practice.

A COMPARISON OF ENGLISH AND AMERICAN PRACTICE IN CABLE MANUFACTURE.

By J. WRIGHT.

A recent article by Mr. Maver, jun., in *Cassier's Magazine*, deals succinctly with the subject of high tension cable manufacture and testing in the United States. This, in view of the importance of the industry in this country, is extremely interesting, and a comparison of the various points enumerated in the article with those in vogue in this, the mother country, may prove of interest to readers of these columns.

Primarily, the writer discusses the relative merits and demerits of aluminium as a substitute for copper in electrical conductors, the result of such discussion being that in view of the increased cross-sectional area of aluminium conductors necessary to procure the same conductance as an equivalent conductor of copper, this metal, although slightly less than one-half the market price of copper, is nevertheless at a disadvantage for insulated conductors in point of view of the extra sheathing and insulation required; but that, on the other hand, it is eminently suited for bare overhead conductors, and has been to a limited extent employed for that purpose.

Another drawback to the use of aluminium which has, I think, deterred English manufacturers from employing it in this connection is the difficulty of making an effective joint, there being at present no satisfactory method of soldering it, although several apparently satisfactory mechanical devices have been mooted for this purpose. Again, in considering the use of aluminium in overhead conductors, we must remember how few overhead lines, comparatively speaking, are at work in this country, and how even these are being rapidly replaced by insulated underground circuits wherever possible. A consideration of this fact renders it dubious whether aluminium, despite its low market price, will ever successfully compete with copper for electrical conductors in this country.

The article then goes on to deal with the initial process of wire manufacture by rolling and subsequent drawing of the ingot, the several stages being practically identical with those in vogue in England. A subsequent paragraph deals with the tinning of the conductor necessary before insulating in the case of a rubber-covered core as a protection from any excess of sulphur in the rubber compound, which would otherwise tend to attack the pure copper.

The next detail is a somewhat important one, as it deals with the moot question of solid conductor and strand. According to the American practice, as described by Mr. Maver, "when the diameter of the conductor does not exceed 0·257 inch in diameter (No. 2, Brown & Sharpe gauge) the conductor is usually solid; that is, it consists of one wire." This statement, if it be correct, indicates a lesser degree of flexibility in electrical conductors on the part of our American cousins than would be tolerated here. In England No. 14 S.W.G., which is ·08 inch in diameter, is usually considered the limit when dealing with insulated conductors. After this dimension has been passed, the conductor becomes stubborn and difficult to manipulate, and usually takes the form of a small strand of six conductors, laid up spirally around a centre straight conductor of equal size. This method in the larger sizes of cable, is extended to 19, 37, 61, 91, and even a greater number of strands, which secure a commensurate degree of flexibility, and, while preserving the original conductive capacity of the conductor, tend to render it easier of manipulation, and less liable to injury than a solid conductor of equivalent carrying capacity.

In America, as in this country, gutta-percha is never used as an insulator for conductors in electric light and power circuits, owing to its low fusing point, which renders it unable to withstand the temperatures frequently attained on such conductors during overload.

The remarks as to the treatment of raw rubber at the factory apply similarly in English practice. One recipe for compound rubber is cited, and runs as follows: "15 lbs. Para rubber, 4·5 lbs. litharge, 6 lbs. whiting, 4·5 lbs. blue lead, 7 oz. sulphur." The resultant compound is unknown to the writer of this article, and its quality is, therefore, beyond his individual criticism. These compounds, as Mr. Maver states, vary with every manufacturer, and may be included under the general heading of "trade secrets."

We now come to the question of the application of the insulating material to the conductor, and here, again, we find a distinction between English and American practice. The primary method of rubber-covering a conductor in the States, according to Mr. Maver, consists in passing the conductor to be covered through a machine similar to that used for gutta-percha work, *i.e.*, the conductor, under moderate tension, is passed through the centre of a die which has a diameter equivalent to that of the covered conductor, the insulating material in a plastic state being forced out under pressure through the die, and around the conductor. As before mentioned, this operation requires the insulating medium to be in a very plastic state, and for this reason alone it has been universally tabooed in this country, owing to the fact that such a quality of insulation, even in its natural unvulcanised condition, must necessarily contain a smaller percentage of pure rubber than that generally adopted in such compounds—a property which debars it from successful competition with the high insulation compounds produced by the alternative process. The method described above is, I believe, very generally adopted by Continental manufacturers as a cheap and easily manipulated system of insulating cables and wires, but English manufacturers will have none of it.

The alternative process, which is the one universally adopted in English cable manufacture, consists in passing the conductor, together with two strips or tapes of rubber, one above and the other below, between a pair of steel rolls, semi-circularly grooved to the finished diameter of the rubber-covered core; the peripheries of these rolls meet and form a cutting edge, which severs the excess of rubber at the point of completion of the insulating sheath, forming a longitudinal seam, which, depending upon the natural cohesion of freshly cut rubber surfaces, is sufficiently perfect a joint to withstand the strain of taping and ultimate vulcanisation, which secures it from parting.

Another method adopted in this country with the larger sizes of stranded conductors, consists in "lapping" the rubber, in the form of tape, spirally around the conductor, each successive layer covering the seam in the preceding one. A very perfect and homogeneous coating is secured in this manner, albeit the process is somewhat slower than the preceding one.

After the first-mentioned method of rubber covering, the core is, according to Mr. Maver, drawn through powdered talc or mica. This apparently acts as a preventive against cohesion between contiguous turns of the core, taping, except with the larger sizes of conductor, being unnecessary with this method of covering.

The object of the subsequent taping with a "proofed" tape, as adopted by English manufacturers, is to temporarily bind the insulating material and thus secure the longitudinal seam from parting during the vulcanising process. The tape also serves another purpose in that it prevents contiguous turns from adhering to one another by cohesion when wound on the drum previous to vulcanisation. In exceptional cases, as, for instance, where a very flexible conductor, such as 35/40, is to be employed for the interior wiring of small-gauge fittings, no tape is specified, and the rubber-covered core is, in such case, coiled into a receiver partially filled with French chalk, embedded in which, it is subjected to the vulcanising process. This French chalk takes the place of the powdered talc alluded to in the American process, in that it prevents undue cohesion of the contiguous rubber surfaces.

As regards the actual vulcanising process, steam heat is universally adopted in this country, as preferable to any other process.

Referring to paper-insulated cables, Mr. Maver discusses a practice which is now common to cable manufacturers of both countries, viz., that of allowing a certain amount of slack in the lapping of the paper strip, which allows contiguous layers of paper to slide over one another when the cable is distorted, and also permits free access to all parts of the impregnating medium, whether it be oil or other material, a condition impossible with tight lap.

The lead-sheathing of insulated cables is dealt with in detail, a diagram of a common type of lead press being added. In this process the American practice apparently corresponds with the English, but one important matter requires improvement, and that is the facility for changing dies. This matter of changing the dies in the press to suit varying diameters of core is with the existing types of lead press a somewhat laborious operation, and requires to be considerably simplified in order to avoid the loss of time which invariably attends this process.

A further detail, which is apparently common to both English and American manufacturers, is that of alloying a small percentage of tin (about 2 per cent.) with the lead, in order to render it slightly more rigid, and also to protect it from the action of acids and corrosive chemicals in the surrounding earth.

No mention is made of the braiding process which is adopted by cable manufacturers to impart a finish, and, to a limited extent, mechanical protection to the insulated core. This is the slowest stage of all, and necessitates the instalment of considerable plant to cope with the supply of core from the other departments of the factory.

With reference to the testing of insulated conductors, American practice again differs from English, probably owing to the fact that high voltages for power transmission and other circuits are more common in the States than in this country. One thing is, however, certain, and that is the present system of "guaranteed megohms per mile," as indicating the insulating quality of a dielectric, measured by the well-known direct deflection method with a high voltage battery and sensitive galvanometer, is being rapidly superseded by the "resistance of a dielectric to disruptive discharge" in terms of the number of volts pressure (alternating) which the conductor will stand when immersed almost *in toto* in a tank of water connected to the remaining pole, or, if sheathed, with its metallic sheathing connected in place of the water.

The English practice in this connection is detailed under the heading of "The Testing of Modern Dielectrics at High Voltages," in a previous issue of this periodical; it will suffice, therefore, in the interests attending a comparison, if we append a brief description of the American methods, and, to this end, we cannot do better than quote an excerpt from Mr. Maver's own description:—

"The pressure test varies with the length of time the test is to be applied. Thus, a cable designed to withstand a pressure of 500 volts may be subjected to a pressure of 2,500 volts for one hour or to 4,000 volts for a few minutes. If intended to withstand a working pressure of 10,000 volts, it may be subjected to 15,000 volts for one hour or to an instantaneous pressure of 30,000 volts. The high pressures for these tests are developed by means of an alternating current generator and step-up transformers. When the apparatus is ready, the wires leading from it are connected to the conductor, and to the lead cover of the cable respectively. In the case of rubber cables, these tests are sometimes applied before the lead cover is put on, the cable being immersed in a tank of water. The ends of the cable are, of course, kept out of the water. In this latter case, the wires run from the testing machine to the conductor of the cable and to the water in which the cable is immersed. If the cable is defective at any point, or if the pressure is too great for the inherent puncture-resisting quality of the insulating material, the current will *jump* and puncture the cable.

"At such high pressures it is obviously essential that much care should be exercised in making these tests. The lead is removed, in the case of rubber cables, for a distance of several inches from the ends of the cable, as, otherwise, when a pressure of 20,000 volts, or 25,000 volts is reached, the electricity will creep along the surface of the insulation (as it may be seen to do, also, on a sheet of thick glass subjected to high pressures), thereby reducing the tension of the current."

A few particulars respecting the general dimensions and voltages adopted in some of the lighting and power mains of New York, and in the United States generally, serve to complete the original article, which, as before stated, has proved of absorbing interest to cable makers and users on this side of the herring pond.

DEATHS FROM ELECTRIC SHOCK.

Fatalities from electric shock have been fairly numerous of late, and, as we suggested in our last issue, it may be thought necessary by the Home Office authorities to insist upon certain well-defined regulations which will tend to prevent similar occurrences. Whether any cast-iron rules would give an immunity from shock we are very much inclined to doubt, because no code of regulations would eliminate the human element, and sooner or later that spells negligence or carelessness. It is not too much to say that many of the accidents that have occurred in this country have been largely contributed to by the unhappy victims, and though sudden death is too heavy a price to pay for momentary aberration from duty, it is nevertheless a lamentable fact that had ordinary working rules been regarded many fatalities would have been impossible.

It is of course satisfactory to learn that taking into account the number of persons engaged in handling dangerous electrical devices, fatal accidents are exceedingly few, but perhaps the most remarkable feature about many of the recent deaths from shock is that they have occurred on low tension work. We would hasten to add, however, that such accidents have been almost wholly confined to private installations; at the same time, they serve to

demonstrate very clearly that what we commonly understand as low tension, is by no means free from danger; indeed, we would go so far as to say that a shock from a circuit of 400 volts would, to many people, be almost as serious as one of 2,000 volts. There might, however, be this difference, that whereas the former would, in some cases, only temporarily arrest the action of the main organs, the latter might destroy tissue from which recovery would be quite impossible. In considering some of the recent accidents, one cannot altogether resist an uneasy feeling that proper treatment may not have been always resorted to. We suppose most people engaged in electrical work know that a person who has received a shock may be restored to consciousness by adopting the Sylvester method of treatment; but it is, nevertheless, surprising to find how many people there are who cannot apply it in the proper manner. Another unfortunate feature about electrical fatalities is that the local medical man who is called in is probably quite ignorant of the physiological action of an electric current on the human body, and he may not be sufficiently interested in the subject to do more than apply the usual perfunctory tests to ascertain whether life is really extinct. But it is worth while considering whether the action of electricity on the body is so subtle that the ordinary tests may be rendered nugatory. In passing, we would observe—though without any intention of disparaging the medical profession—that, with a few prominent exceptions, medical men have not paid sufficient attention to the probable effects of electricity on the human body. These effects are so widely divergent in their character that the ordinary layman has a right to appeal to the medical profession for assistance in elucidating some curious features which attend death by electric shock.

The most recent fatality from electric shock occurred last month at the electricity works of the Blackheath and Greenwich Electricity Supply Company, which makes the second fatal accident since February last. It should be explained that these works generate high pressure two-phase alternating current, the difference of potential at the switchboard being 3,000 volts. The first accident—which was recorded at the time—resulted in the death of a switchboard attendant, and a significant feature attaching to the incident was that the unfortunate victim had himself made all the connections on the board, and was, in fact, practically responsible for its construction. Therefore this accident could not have arisen from any ignorance as to the details of the board or from a lack of appreciation of the danger. The second accident, which has been recently investigated by a coroner's jury, occurred also at the switchboard, but the unhappy man who met his death was not engaged on the staff of the supply company, but was a carpenter's mate who was assisting in the erection of a wooden rail, which was to be placed in front of the board. It appears that instructions were given that the men were on no account to touch the board, but as far as can be ascertained an attempt was made to remove certain bolts from the board, and in doing this the man for some reason or other touched a main terminal, and the other hand being earthed through the bolt the full effect of 3,000 volts was experienced. Here, again, we see the element of carelessness on the victim's part, but it should never have been possible for any stranger to have tampered with the board, and we are afraid a certain responsibility rests upon the management of the station. It is extremely regrettable that such an accident should have arisen, and while one's sympathies must be extended to the friends of the victim, one cannot wholly withhold them from the company or from the staff.

The accident, however, suggests that the type of switchboard in use at Blackheath may have elements of danger in it; if these exist no doubt they will be remedied. It is not impossible to design a switchboard, which, while giving rapidity of operation, is practically free from danger; there are scores of boards all over the country from which it would be practically impossible for a stranger to receive a shock unless he were bent on suicide. As a matter of fact, as far as possible, immunity from accident has to be provided, and even the carelessness of workpeople must be guarded against.

We are not suggesting that engineers do not make provisions against accidents, but it must not be forgotten that there are occasionally men employed in central stations who are ignorant, and oftentimes contemptuous, of the danger that exists; and though it might be impossible to give absolute immunity, still no effort should be spared to afford security against carelessness and ignorance. But another point of equal importance is, that all persons on the staff of electricity works should receive instructions in the method of restoring consciousness after shock; the treatment cannot always be effectual, but it is the best aid one knows of at present, and the success that has followed an intelligent application of it suggests that it should be persevered in.

CURRENT SPECIFICATIONS.

XXXV.—KENDAL ELECTRIC LIGHTING.

SUMMARY.

Extent of Contract.—Complete equipment of generating station.

Proposed System.—Direct current three-wire, with a battery of accumulators to be used for balancing purposes.

Type of Boiler.—"Economic" or dryback single-flued boiler of approved make.

Number and Size.—Two required, each to be capable of easily evaporating 2,500 lbs. of water per hour with hot feed, and draught equal to ⅜ inch of water with a consumption of best Welsh steam coal not exceeding 1 lb. per 10 lbs. of steam from and at 212° F.

Working Pressure.—150 lbs. per square inch.

Boiler Feed Pumps.—One duplex type to deliver 800 gallons per hour, and one motor-driven three-throw pump to deliver 500 gallons per hour against working boiler pressure.

Type of Engines.—To be of some well-known first class make, and vertical quick revolution, compound enclosed type.

Number and Size.—Two required, each to drive a dynamo giving 36 KW. as normal full load, or 43·25 KW. for periods of one hour, with increase of normal speed not exceeding 10 per cent.

Specified Speed.—Not to exceed 380 revolutions per minute.

Type of Governor.—To be of throttle valve type positively driven, capable of hand adjustment.

Range of Governing Required.—Within 5 per cent. from full load to open circuit when load is thrown off.

Output of Dynamos.—At normal speed, rated full load to be 80 amperes × 450 volts = 36 KW., each to be capable of giving up to 500 volts at an increase of speed not exceeding 10 per cent.

Overload Current.—95 amperes for one hour.

Permissible Temperature Rise.—After six hours' normal full load run not to exceed 70° F. above surrounding atmosphere, the rise in temperature being measured thermometically.

Specified Steam Consumption.—Not to exceed 38 lbs. per KW.-hour when working non-condensing at normal full load and supplied with reasonably dry steam at 150 lbs. square inch pressure.

Size of Traveller.—One overhead traveller to be supplied suitable for a working load of three tons and a span of 26 feet.

Main Switchboard.—To be suitable for two dynamos, each feeding the outer conductors of a three-wire system, a battery of accumulators, and two feeder circuits.

Type of Battery.—To consist of Tudor type cells L.A. 7 size.

Number and Output.—240 cells to be supplied, the battery to be capable of discharging at the rate of 21 amperes for 10 hours, and then having a voltage across terminals of not less than 440 volts. The normal maximum discharge not to exceed 55 amperes, but for periods of not more than half an hour the cells to be capable of giving without injury an emergency discharge of 90 amperes.

Maintenance Guarantee.—The sum per annum to be stated at which the battery manufacturers will undertake the maintenance of the cells to 100 per cent. of rated capacity for a term of ten years.

Lighting of Station.—The generating station to be wired for 29 points as scheduled.

Specified Date for Completion.—Nine months from date of order.

Penalty for Late Completion.—£25 per week.

Terms of Payment.—Seventy-five per cent. of value of work executed on site and plant delivered on site during month until the balance of 25 per cent. of value of executed work equals 10 per cent. of total value of contract. Thereupon 90 per cent. of finished work until completion of contract; 5 per cent. of contract sum on plant being put into continuous effective use; 5 per cent. six months later.

Stipulations as to Removal of Foreman.—Satisfactory.

Stipulations as to Wages Paid to Workmen.—None.

Arbitration Proposals.—Satisfactory.

Date for Receipt of Tenders.—November 25th, 1900.

This specification has been prepared by the consulting electrical engineers to the Corporation, Messrs. Handcock and Dykes, of 1, Victoria Street, Westminster.

The Kendal Town Council certainly cannot be considered to be very sanguine as to the probable demand, since two 36-KW. generators and a small battery of cells form the whole of the plant now asked for. We think it is a pity that a bolder spirit has not prevailed, for if the experience of other towns is taken as any criterion, the demand will soon

overtake the rated output of the present plant, larger units will be necessary, and the present sets will be for disposal owing to the space they occupy being required for other sets. It is not only very difficult to earn any real profit with such toy installations, but their relative cost is very high, and a large portion of the equipment—for instance, the pipework, boiler feeding arrangements, switch gear, &c.—requires to be practically remodelled when any large extension is required. We are aware that the engineers have done their best, and made provision for two extension sets in the design of the engine room, but, unless we are much mistaken, the demand will soon outgrow even this provision.

It will be noticed that boilers of the dryback type are specified. We think that the engineers have acted wisely in thus indicating their preference for a type of boiler which has not met with the appreciation for country central electric lighting stations which its merits deserve.

With regard to engines it is expressly stated that tenderers are at liberty to offer alternative types.

The only technical point which we think needs special attention is the provision for cell charging; the method of cell charging proposed not being, in our opinion, the most suitable to employ, especially in view of the fact that no balancing arrangements other than the cells are provided for.

A sum must be stated in the tender at which the cell makers are willing to undertake the maintenance of the cells for a period not exceeding 10 years, to *the normal full capacity of the battery.*

The general conditions are, as a whole, acceptable, the clause relating to drawings being fair to both purchaser and contractor.

It reads :—

The drawings with the specification are to be considered binding as regards general scheme and arrangement of works specified, and all the measurements specially marked on the plans shall be rigorously adhered to. Where the engineers give their approval in writing to any particular appliance as complying with the specification and being approved by them, the drawings shall be considered binding only so far as indicating the relation of that particular appliance to the general scheme of the works as a whole.

At the time of submitting the tender general drawings only of the special arrangements allowed for in the tender are required, but the engineers may call for more detailed drawings if they consider them necessary before any specified tender is accepted.

After the tender is accepted, and before the work is put in hand, detailed drawings shall be submitted to the engineers for their reasonable approval.

The contractor shall, at his own expense, supply to the engineers copies of the drawings necessary for the erection of the works under the contract, but shall not be called upon to furnish constructional details further than in the opinion of the engineers are required for the purposes of the contract.

If the contractor shall be called upon to supply additional copies of the drawings, they shall be paid for at a fair price to be arranged. The engineers shall, in addition, have the right at all reasonable times to inspect any drawings of any portion of the plant contracted for at the works of the manufacturer.

The contractor shall also supply two drawings or prints showing the diagram of and actual connections on the main switchboard, one being framed and glazed to hang in engine room.

The penalty for late completion of the contract is £25 per week, and this is to be exacted :—

Unless *the execution of the contract works shall have been delayed by an unreasonable strike of the workmen, by excessive inclemency of weather affecting the work of the contractor, or by any circumstances over which the contractor shall have had no control;* provided that *no such damage shall accrue as payable by the contractor to the Corporation after the time when the plant is complete and ready to be set at work.*

It would be well for contractors if some such saving clause as this were inserted into all contracts; at present in many cases there is a disposition to make the contractor liable not only for preventable causes, but also for those over which he has admittedly no control.

The clauses relating to disputes and their settlement leave little to be desired. They state :—

The engineers' interpretation of the specification and drawings in every case to be taken as decisive and final, as is also their decision as to the quality of materials and workmanship, *subject only to arbitration as herein provided.*

The engineers' decision to be final in all the matters in this specification provided for, *saving only that the contractor may, by giving notice within six days to the Corporation, claim to have the matter submitted to arbitration as herein provided.*

In case any dispute shall arise between the Council or their engineers on their behalf and the contractor, either during the progress of the works or after the determination, abandonment or breach of contract, as to the construction of the contract or as to the reasonableness of any charges or as to the withholding by the engineer of any certificate to which the contractor may claim to be entitled, then either party may give the other notice in writing of the existence of such dispute or difference, and claim to have such dispute or difference referred to the arbitration of two arbitrators, one appointed by each party, which arbitration shall be deemed to be a submission to arbitration within the meaning of the Arbitration Act of 1899, and the award of the arbitrators or their umpire shall be final and conclusive, and no action shall be brought in reference to the matter except for the purposes of enforcing the award.

We can only state that if all specifications were drawn up in a similar manner to this one, there would be no need for the continuance of such a serial as this, for contractors would be able to accept contracts as offered, knowing that their own, as well as the purchaser's interests, were safeguarded in the provisions attached thereto.

CORRESPONDENCE.

Proposed Electrical Contractors' Association.

Has the proposal to form a contractors' association been dropped? There cannot be any doubt that we cannot go on much longer unless we protect ourselves, not only against the action of manufacturers complained of by Mr. Leach, but also against the steadily increasing number of so-called electricians who set up in business as electrical contractors, because they have seen somebody wiring for electric bells, and cannot find a job in another employment. A further need for protection may be found in the clauses of every specification sent out by the consulting engineers, &c. Besides protection, the object of the association would have to be a standardising of the work and materials, which presents less difficulties than it seems. This would tend to raise prices, which at present are simply ruinous, and to show the value of the combination to clients.

As regards the test for admission, I should propose that for a period of, say, three months after formation of the association, every contractor who has been practising for at least 12 months should be admitted. After that time admission would be gained on the recommendation of two members, or on proof that the applicant has been engaged in the trade for, say, three years.

A list of manufacturers to be kept. Every member of the association to whose knowledge a case of direct supply to a customer at trade prices by a manufacturer is brought, would be required to report to the Association, who would investigate the matter and boycott the manufacturer, if the the case is proved.

A list of competent wiremen to be kept. References to go through the Association. All wiring to be done by registered wiremen, and not by joiners, &c.

Materials, &c., should be standardised, but I prefer to leave details to a meeting or further discussion in your columns.

A minimum price per light or per point might be fixed.

A standard specification should be drawn up and tendered to. If specifications do not conform to same, no member of the Association to be allowed to tender.

Consulting engineers who are contractors at the same time should not be recognised as such, and members would not be allowed to tender to their specifications.

A combination governed by rules, of which the above may be taken as a general outline, should fulfil its object, and I consider that our trade papers should take the matter up and receive applications of intended members until a meeting could be arranged.

A Contractor.

[This matter is referred to in our "Notes" columns.—Eds. Elec. Rev.]

Comparative Cost of 100-Volt and 200-Volt Supply.

It would, I think, be a matter of general interest if some of your readers could give statistics, obtained in actual working from meter and current readings, of the comparative cost—before, and after, the change over—of electric lighting where consumers have been changed over from the 100 to the 200-volt street supply service.

According to my own experience, I find that hitherto the cost after the change has, on the average, considerably more

than counterbalanced any rebate held out by the supply companies as an inducement to their customers to adopt the change, and this after entirely leaving out of account the extra cost of lamp renewals, the difficulty of getting satisfactory lamps of small candle-power, and the disadvantage of not being able to use the miniature lampholders hitherto in use for decorative fittings.

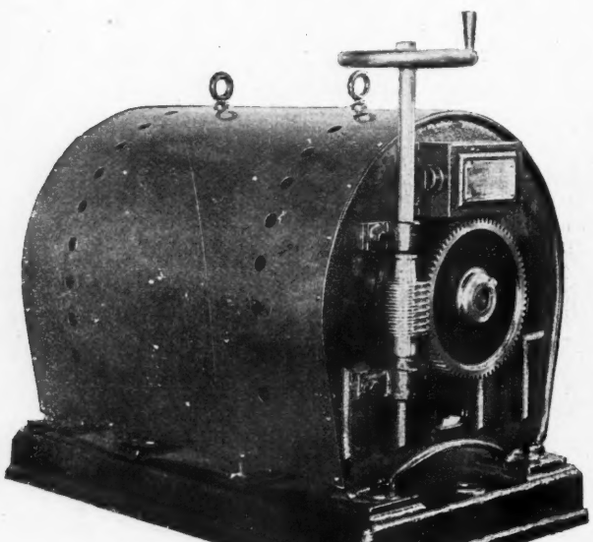
C. E.

Transformers for Cable Testing.

With reference to Mr. Wright's article on high voltage tests for cables which appears in your issue of October 26th, we see that this contains a statement to the effect that there is no transformer on the market specially designed to meet the requirements of such tests.

We should like to point out that the special variable ratio transformer, of which we enclose an illustration, is designed for this purpose; it can be used in connection with any existing alternating current supply, and will give any voltage at its secondary terminals, between zero and the required maximum, by merely turning a handle.

As the variation of pressure is absolutely gradual, that is to say, without sudden jumps, such as would occur if a



Cowan-Still Patent Regulating Transformer for a Normal Output of 20 h.p.

switch were used for cutting out sections of the winding, the advantages of this apparatus over any arrangement involving the continual running up and slowing down of an alternator will be obvious.

Although we constantly wind these transformers for pressures of from 2,000 to 3,000 volts, it would, of course, be practically impossible to wind them for the very high pressures which are now frequently used for insulation tests, and they are consequently used in connection with special extra high pressure step-up transformers, preferably oil insulated, by means of which any voltage up to, say, 30,000 volts, can be obtained for cable testing, and for certain tests of insulating materials, 100,000 volts, or even more.

Cowans, Limited.

Salford, Manchester.

LEGAL.

The National Free Wiring Company *v.* Jones.

His Honour Judge Lumley Smith, Q.C., in the Westminster County Court on Friday last, had before him an action by the National Free Wiring Company, of Charing Cross Road, to recover £61 from the proprietor of an hotel in Suffolk Street, Pall Mall. There was a counterclaim for damages for bad workmanship and for loss owing to the plaintiffs delaying the work.

Plaintiffs' case was that Mr. Jenkinson, their late manager, entered into a contract with the defendant to wire the place, put in 43 switches and 56 lights. There were continual complaints, all of which were attended to. The contract price was £52, and the balance of the account was for extra fittings. The work had to be done at times convenient to the defendant, and that was why it was delayed in completion, and the best of workmen were not employed though they were capable. On one occasion they found a fuse blown, and that was said to be caused by someone tampering with it. The wire was patent lead-covered, and if the wall paper was damaged by the oil from it they must bear the consequences.

Mr. R. J. Drake, for the defendant, called evidence to show that the work was very badly done, and there was great damage from fire. The contract to do the work to the satisfaction of the defendant and the insurance company had not been performed. Instead of the work taking about a fortnight it occupied four months, and Messrs. Dawson were now altering it at a cost of £22, though that would not make a good job of the whole, only of the worst portion. The damage to the walls would cost quite £15 to put right. A number of guests were lost by the delay. His Honour found for the plaintiffs on the claim for the amount claimed, and for the defendant for £37, remarking that he was of opinion the work was badly done. Each party would have costs on their respective verdicts.

Lang *v.* Lamplough.—Volenite, Limited.

The hearing of the action of Lang *v.* Lamplough, which has occupied Mr. Justice Mathew, sitting to try commercial cases in the Queen's Bench Division, for several days, was concluded on Friday last. The claim was for £12,898 for goods sold and delivered, and the defendant denied liability, stating that he ordered the goods for "Volenite, Limited."

The case for the defendant, according to Mr. Lawson Walton, Q.C., who opened it, was that he did not dispute that the goods were delivered. He was, it appears, a chemist and an engineer to the Board of Trade. He was also employed by the Fish Oil and Guano Company, Limited, and whilst he was in the service of that company he invented an article called volenite. It was a substance from which, owing to its chemical composition, could be produced a perfectly water-tight composition suitable for, amongst other things, electrical insulators. In due course a company, called Volenite, Limited, was formed for the purpose of putting the material on the market. The company was promoted by the Fish Oil and Guano Company, Limited, which obtained 40,000 £1 shares for the patent. Mr. Lamplough received 2,000 shares. After "Volenite" was floated works were established, Mr. Lamplough being appointed advising chemist at £300 a year. The management of the works, however, proved unsatisfactory, and Mr. Lamplough was finally appointed, practically, manager. "Volenite, Limited," had little or no capital, and it became necessary to find further working funds, and Mr. Lamplough found £10,000, for which he was personally responsible. In return for that the Fish Oil and Guano Company undertook to give him the option on £5,000 shares at £2 each. As a result of his management, the Fish Oil, &c., Company was able to pay 10 per cent. dividend, and its shares were quoted at £39. Volenite, Limited, was dealt in at 2¼, although it had only manufactured a few samples. Subsequently Mr. Lamplough, as agent for the company, entered into business relations with Mr. Lang, who supplied the various goods which were the subject of the action, and counsel submitted that Mr. Lamplough, in all these transactions, had only acted as business manager for the company.

Mr. Lamplough was called, and gave evidence in support of his counsel's statement, and other evidence was called to the effect that when Mr. Lamplough ordered the goods in question, he was acting on behalf of Volenite, Limited.

Mr. Rufus Isaacs, on behalf of Volenite, Limited, contended that the company was not liable for the goods supplied to Mr. Lamplough's order, and that Mr. Lamplough had entered into a contract to supply the goods in question on his own account.

Among other witnesses called was Lord Lurgan, who said he was formerly chairman of the Volenite Company. Mr. Lamplough arranged with his bank for an advance of £10,000 to provide working capital, machinery, &c. They hoped to make a great profit.

There was considerable argument on the points raised, and in the end his Lordship said he would take time to consider his decision.

Mr. Justice Mathew, in giving judgment on Monday, said it was an action brought by Mr. Lang, a merchant in the City, against the defendant, Mr. Lamplough, to recover a sum of about £13,000 for goods bought and sold, or, in the alternative, damages for refusal to accept them. The goods consisted mostly of a substance or gum called Ponteniack, which was worth about £20 per ton, and was used for various purposes, such as the manufacture of electrical insulators. The defendant described himself as a chemist and engineer, and as an engineer he appears to have had a good deal to do with engineering and promoting companies. He appeared to have acted as manager to the Volenite Company, Limited, from October until 1899, when this action was brought against him with the Volenite Company as third party. It was alleged that in making the purchases, which were the subject of the action, he acted as agent for the Volenite Company, and was entitled to be indemnified by them. On the original action an order was made on terms he need not mention, that execution should be stayed until it had been determined whether Mr. Lamplough in his connection with

the Volenite Company was entitled, as manager, to an indemnity for the claim of Mr. Lang. That he was entitled to such indemnity was wholly denied by the company. That was the question of fact to decide, and it was not an easy one to solve. Before entering on the material facts, it was necessary to refer to three limited companies. First there was a company established in Dublin—the Fish Oil and Guano Company, Limited—and to that company Mr. Lamplough was chemist and adviser. The company was formed for the purpose of extracting fish oil; it was assumed that that fish oil, if extracted, would be valuable for a vast number of purposes, and it was an article for which there would be an extensive sale all over England. The company was in existence for some years, and the astonishing result was arrived at that the £1 shares in the company were sold in the market for £39. By what powers of engineering or otherwise that was brought about he did not know. The shares were not now of that value, but that was the condition of things in the year 1898, when Mr. Lamplough, being employed as their chemist, and making experiments, alleged that he had discovered a new material, called volenite, which was to be manufactured of various ingredients, including fish oil, to be obtained from the Fish Oil Company. It did not seem that this volenite was ever manufactured in any quantity, but such was the confidence in the product and the patent that the shares in the company, after it was formed, went to a premium of from 2 to 2¾ per cent. The nature of the material he was not clear about, but it was intended to be an insulating compound, and to be used for steam jointing and for many of the purposes for which india-rubber or gutta-percha was used. The new company was formed, the main shareholders being the Fish Oil Company. There were, it appeared, 80,000 shares in the Volenite Company; 40,000 of those went to the parent company in consideration of its paternal solicitude, and the remaining 40,000 shares were to supply the working capital. The defendant, Mr. Lamplough, had 2,000 shares in consideration of his services as chemist and engineer, and then there was a new company, the Rhea Fibre Company, which had been promoted by a person named Cordner, who had taken out a patent for a new material analogous to Volenite, but made in a different way. He must say that with regard to these companies there was one characteristic—none of the material they were born to manufacture was ever produced; but, nevertheless, they seemed to have had a more or less flourishing existence. Their shares were dealt in to some extent, and were of considerable value; but their existence was merely on paper. As to Volenite, some machinery was got, but nothing was done: as a consequence the shareholders began to be uneasy, and about the middle of last year the company discovered that it was practically insolvent—it had exhausted all its capital, and had no money. It was then that Mr. Lamplough appeared to have come to the rescue and offered to raise some £5,000 for increased works, and £5,000 for working capital, by becoming security at the bank. It was, however, thought that that would not satisfy the meeting of shareholders which was shortly to be held, and that some evidence should be afforded of very large orders having been given by somebody. Mr. Lamplough put himself in communication with Mr. Cordner, who represented the Rhea Insulating Fibre Company, and a suggestion was made that an order should be given by the Rhea Company to the Volenite Company, not for their own material, but for the manufacture of the Rhea mixture, the Volenite Company to have 10 per cent. profit over the cost of production. Arrangements were made as to the payment of the money by instalments, and a correspondence which took place was produced and read in Court. There were meetings of directors of the Volenite Company, and it was contended, on behalf of Mr. Lamplough, that he was authorised by the Volenite Company to buy the material for carrying out the order. On the other side that was denied, and he had to decide which was the correct version. At any rate, there was a meeting of shareholders in Volenite, Limited, later, and the chairman, Lord Lurgan, addressed them. One did not attach much importance to such utterances as a rule, but he must say that he had never encountered a statement so wholly wanting in accuracy as the statement made by Lord Lurgan. The shareholders were told that orders had been obtained for the manufacture of material worth over a quarter of a million of money, and Mr. Langworthy was present. It was clear, at any rate, that Lord Lurgan did not make a clear and careful statement of the arrangements between Mr. Langworthy and the Rhea Company; and there was a stupendous suggestion made as to the machinery required and the orders—a quarter of a million. His Lordship then went into the correspondence between Mr. Cordner and Mr. Lamplough, and Mr. Lang, the plaintiff. He said it appeared that the Volenite Company was never informed of what had been done. Mr. Lamplough subsequently wrote for the balance of his £10,000, and threatened to close the works. He said he was doing the best he could for the company, but he required a little help, as he had been spending large sums on material. Then the company wrote that he had purchased material without their authority, and the result was the action. Having alluded to the fact that the plaintiff had called no witnesses in support of his statement as to his alleged arrangement with the company, and as to his having forwarded the plaintiff's contract notes to the company, he said he was constrained to come to the conclusion that the contract notes were not sent, and that no information whatever was given to the Volenite Company as to these transactions. Defendant said he made the purchases from Mr. Lang in good faith and on behalf of the Volenite Company, but why he made them he (his Lordship) could not imagine. He was satisfied that he did not act as the Volenite Company's agent, and he gave judgment, therefore, for the Volenite Company on that part of the case with costs. As to the action between Mr. Lang and Mr. Lamplough, counsel must consult together and mention the matter to him again.

The London Electrical Cab Company, Limited.

The petition of C. E. Foster and others for the compulsory winding-up of the London Electrical Cab Company, Limited, which was before Mr. Justice Wright last week, was again mentioned before his Lordship on Wednesday. Counsel for the petitioner now said that he was instructed to consent to his Lordship's suggestion that a provisional liquidator should be appointed.

His Lordship accordingly made an order that the Official Receiver should be appointed provisional liquidator, and the question of costs was left over until a future sitting of the Court.

THE RESPONSIBILITIES OF TOWN COUNCILLORS.

The Manchester City Council has been engaged during the past week in inquiring into certain allegations reflecting upon the chairman of the Electricity Committee, with the result that that gentleman has resigned his position as alderman and councillor. Mr. Lloyd Higginbottom was not only chairman of the Electricity Committee, but had so far acquired the confidence of his fellow-citizens as to be nominated for the highest office the municipality can bestow. When therefore Mr. Norbury Williams, one of the elective auditors for the city, issued to the ratepayers an address which constituted a personal attack on Mr. Higginbottom in regard to his relations with traders and the Council, it is not surprising that some sensation should have been caused in Manchester, or that some of the effects of the explosion should have been widely felt. Mr. Williams's attack was somewhat discursive. He introduced the names of Messrs. Ferranti, Limited, and the British Insulated Wire Company without any other justification than that Mr. Ferranti was a director of the Wire Company, and that some directors of the Wire Company were co-directors with Mr. Higginbottom on a third company—the British Electric Works, Limited. He further suggested that the Electricity Committee sold current for motors at an abnormally low price, in order that Mr. Higginbottom's firm might have an increased business in the fitting of motors. But the most direct charge centred in the supply, for the electricity department, of some cranes which Mr. Williams alleged were made by Mr. Higginbottom's firm, and invoiced in other names. Mr. Higginbottom lost no time in appearing before the Council and answering the indictment. He held no shares directly or indirectly in Messrs. Ferranti or the British Insulated Wire Company. The British Electric Works had submitted a tender to the Corporation, but he ruled it out. The suggestion regarding the low price of electricity was prompted by crass ignorance, and the inference that he had been instrumental in fixing low prices of current so as to make a profit in fitting motors was too absurd to consider. With regard to the cranes, Mr. Higginbottom explained his position as a maker of certain parts, described Mr. Williams's statements as "quite untrue," and characterised "the insinuation that his firm had done business with the Corporation under the cloak of other names" as "entirely lacking in foundation." An appeal to the Council to accept Mr. Higginbottom's explanations was met by the appointment of a committee, which now reports that the circumstances referred to in connection with Messrs. Ferranti have no bearing on the subject of the inquiry; the Committee is satisfied that Alderman Higginbottom is not interested in the British Insulated Wire Company, and that neither the action of the British Electric Works, nor that of Alderman Higginbottom as its chairman, has been such as to give rise to any substantial cause of complaint. The imputation that Alderman Higginbottom was instrumental in reducing the price of supply for motors in order to promote his own business interests is absolutely without foundation. But with regard to the cranes the Committee gives instances of contracts undertaken by other firms for whom Messrs. Higginbottom & Mannock acted as sub-contractors. The aggregate amount of the contracts, where the prices are given, is £5,861, and of the sub-contracts £4,229, or nearly 75 per cent. The Committee expresses the opinion that the action of Alderman Higginbottom with respect to these sub-contracts has been altogether improper.

Following upon this report, Alderman Higginbottom sub-

mitted his resignation, which was accepted by the Council, and the present Lord Mayor is nominated for a continuance in office.

During the course of the discussion, Mr. Higginbottom has received many expressions of kindly feeling, and many testimonials for his hard work and labour on behalf of his city, yet the justice of the Committee's decision and the necessity for his resignation of office, is generally admitted. A Town Councillor, like a Member of Parliament, has many privileges. In return, he has one important restriction to bear in mind. He must not trade with his municipality. The proverb that no man can serve two masters finds expression in the Municipal Corporations Act of 1882 in the provision that a councillor shall be disqualified if he has, directly or indirectly, by himself or his partner, any share or interest in any contract with, by, or on behalf of the Council. The development of Limited Liability Companies, the specialising of manufacturers, and the consequent system of sub-contracting for parts of large contracts have occasionally rendered the rigid exclusion from interest or profit a matter of some difficulty, but we trust that the existence of shareholding interests and the multiplication of sub-contracts have not been generally utilised to permit a type of trading which is contrary to law. It is to be hoped that the cases in question are peculiar. It must be obvious that compliance with the spirit of the Act is not attained when a town councillor can participate to the extent of something like 75 per cent. in contracts of which only the balance of 25 per cent. lies with the nominal contractor.

It is satisfactory to note that the Committee finds no cause for censure in connection with the electrical concerns mentioned. With regard to the British Electric Works, however, something should be said, aside from the question of direct trading with the Corporation. Mr. Higginbottom's connection with the company was entirely open and above board. There was no attempt at concealment. Mr. Higginbottom's *bona fides*, so far as regards that company and the Corporation, need not be questioned, and yet it may be remarked that the connection was ill-advised. Before granting that the Corporation suffered no ill, there may be some advantage in asking whether the company obtained any benefit from the connection? The inference to be drawn from the open way in which Mr. Higginbottom's name was advertised is, that the company saw some advantage from the connection, and we do not hesitate to say that any advantage accruing to the company carried with it a corresponding disadvantage to the Corporation. The influence of a councillor and a committee chairman should be a potent influence, and it should be jealously guarded.

The company in question dealt, or hoped to deal, rather with the public than the Corporation. The chairman of the Electricity Committee has subordinates and the director of the limited company has subordinates. With the best intentions for fair dealing neither the one nor the other can entirely control the operations of those subordinates, and it may be readily conceived how the combination of such offices might in the present push of business operate to the direct disadvantage of independent traders and the indirect disadvantage of the people of Manchester.

On a careful review of all the circumstances, we can only arrive at the conclusion that Mr. Higginbottom retires from the Council and relinquishes the honour of the chair, because Mr. Higginbottom's views of the relation of public office and personal profit are too wide, and his interpretation of Acts of Parliament too narrow. His labours on behalf of his city may be considerable, but they must be set aside, as they have been set aside by the Committee. Doubtless his experience as a manufacturing engineer has been of great advantage to the Electricity Committee, but it may be seen what a disadvantage it is to the community when, possibly, a political rival is enabled to make an unfounded charge about motor rates, simply because the chairman of the Electricity Committee is engaged in fitting motors. Mr. Higginbottom considered it nonsense that his firm should be debarred from doing business with the citizens of Manchester because he was a member of the Corporation and chairman of the Electricity Committee. We can conceive the argument being developed so as to show that the municipality is under a debt of gratitude to the electricity chairman who, as Mr. Higginbottom in his private capacity claims to have done, made a special study of electric hoists and fitted motors therefor, but the argument is a dangerous one. The study and the fitting may be done by others. The reason why these occupations should not be combined with the holding of a public office, is that they may raise conflicting interests. A citizen is under no obligation to accept public office; but, having accepted it, he is under the obligation that he shall not derive any profit from trading with the community for which he is a trustee. This is clearly understood and acted on so far as direct trading is concerned. The salutary lesson in the present case is that indirect trading is regarded as equally improper. Were it not so there would be no end to its insidious influence, no limitations to its ramifications.

BUSINESS NOTES.

Electrical Wares Exported.

Week ending Nov. 7th, 1899.	Value £
Adelaide	180
Alexandria	106
„ Teleg. wire	89
Amsterdam	88
Antwerp	90
Beira	75
Bombay	86
Boulogne	40
Brisbane. Teleph. cable	890
Buenos Ayres	2,326
„ Teleg. mat.	925
Calcutta	86
„ Teleg. wire	104
Cape Town	377
Channel Islands. Teleg. poles	120
Colombo. Teleg. mat.	10
Copenhagen. Teleg. wire	33
Demerara. Teleg. cable	448
„ Teleg. mat.	67
Durban	141
„ Teleg. mat.	3,166
„ Teleph. mat.	160
East London	257
Gothenburg	116
Hamburg	121
„ Teleg. mat.	435
Hobart. Teleg. wire	19
Hong Kong	40
„ Teleg. mat.	24
Jamaica. Teleg. mat.	14
Madras	244
Mauritius. Teleg. stores	35
Melbourne	188
Ostend	80
Port Elizabeth	40
Rangoon. Elec. mining machy.	1,000
Rotterdam	175
Shanghai	394
Singapore	87
Stockholm. Teleg. mat.	167
Sydney	1,391
„ Teleg. mat.	76
Tokio. Teleph. cable	1,278
Valparaiso. Teleg. mat.	114
Wellington	112
Total	£15,974

Week ending Nov. 6th, 1900.	Value £
Brisbane	63
Buenos Ayres	44
„ Teleg. mat.	213
Calcutta	632
Cape Town	154
Colombo	102
Copenhagen. Teleg. wire	38
Durban	106
East London	245
„ Teleg. mat.	205
Gibraltar	20
Gothenburg	19
„ Teleg. mat	39
Shanghai	14
Hamburg. Teleg. mat.	300
Hong Kong	171
Liban	140
Lyttelton	44
Madras. Teleg. mat.	100
Malta	153
Nagasaki	9
New York	92
Ostend	71
Penang. Teleg. mat.	1,172
Perth	352
Port Elizabeth	655
Port Said	15
Singapore	70
Stockholm. Teleg. mat.	79
Sydney	1,731
Teneriffe. Teleg. cable, &c.	486
Tokio. Telephones	90
Total	£7,379

Foreign Goods Transhipped.

	Value £
Brisbane. Teleph. appar.	65
Piræus. Electrical goods	28
Total	£93

Alleged Nuisance.—At the Lambeth Police Court last week, acting upon a requisition served upon them by the inhabitants of the district, the Lambeth Vestry summoned the South London Electric Supply Corporation, Limited, of Bengeworth Road, Loughborough Junction, before Mr. Hopkins, in respect of an alleged nuisance arising from the burning of refuse at their works. After discussion, the summons was adjourned upon the understanding that the burning of the refuse would be discontinued.

Auction Sales.—In an advertisement this week will be found particulars of the sale by auction of an electrical engineer's business in South-West London.

Messrs. Wheatley Kirk, Price & Co. are to sell by auction the freehold works lately occupied by the Aluminium Company, at Oldbury, Birmingham; also the electric light and power plant at the same works, of which details are to be found in our advertisement pages this week.

Catalogues and Lists.—Messrs. Caird & Rayner, of Commercial Road, E., send us a copy of their very neatly-bound descriptive catalogue of specially-designed apparatus for the production and treatment of pure fresh water on land or at sea. With a series of excellent photographic and other illustrations, together with a good deal of letterpress, they place before the reader information regarding their evaporators, condensers, feed heaters, and pumps. Their apparatus is being employed in parts of the world where the available water is anything but pure, and where, consequently, its treatment is an important matter in connection with boiler feed. Their purifying apparatus is rendering very useful service in a host of warships and vessels in the mercantile marine.

The catalogue of the British Mannesmann Tube Company, Limited, is interesting to electrical engineers, chiefly for the reason that it places before them particulars of their various designs of electric light and traction tubular poles. What is particularly claimed for them is that they are of great strength compared with their weight; it is also considered that their smooth surface renders them specially well adapted for use in main thoroughfares where ornamentation is essential. The Mannesmann poles are employed in various English and Continental cities for these classes of work. The company does not confine itself to the bare pole part, but also carries out the scroll work for tramway bracket arms, and arc lamp standards. Some of the designs shown in the lists before us are very neat indeed. The makers, of course, are known as manufacturers of boiler and stay tubes, and steam tubes and fittings, well-casing tubes, and a large variety of other work in the same line. The catalogue before us particularises and prices many of these in tabulated form, and accompanies the details with excellent illustrations.

Lunkenheimer's double-seated "Victor" gate valves are manufactured by the Lunkenheimer Company, Cincinnati, O., who have branches in various other American cities, and are represented in London at 35, Great Dover Street, S.E. These valves are being largely used for high pressure power plants, and are guaranteed for a working pressure up to 175 lbs. per square inch. It is claimed that the seat rings, as well as the wedge disc, can be renewed when worn. In finishing the interior of the valve body, the portion which receives the seat rings is threaded to the correct angle of the tapers of the valve disc. The seat rings are threaded and faced off straight, and when screwed in place, they fit accurately to the tapers on the disc. This method is claimed to be superior to finishing the tapers of the discs on the seats, after the latter are screwed in place, because if the seats in valves constructed in this manner should become slightly unscrewed, they would not fit the disc tapers, and in no event could they be renewed. Either pattern of "Victor" valves can be packed under pressure; to do this the valve must be wide open. The disc is accurately guided in the body, so that it can be moved freely, and the stem is relieved of all side strains, which have a tendency to wear out the threads on the latter. It is stated that all parts are heavy, yet compact. This point will be appreciated when comparison is made with some other forms of valves. The strains on the connecting pipes (due to the weight of valves) are minimised, and also owing to their compactness, they are not affected to any extent by expansion or contraction. The joint between the body and hub is practically indestructible. It consists of grooves cut in the top surface of the valve body, in which are placed seamless copper gaskets. A joint made in this manner will not leak or wear out. All wearing parts are made of best bronze composition, and the body and hub of close-grained hard iron. They are made in several forms, with either stationary or rising stems. A copy of the supplement to the Lunkenheimer 1898 catalogue of valves and engineering specialities is before us. Although only a supplement, it consists of over 200 pages of different valves and other fittings, of which illustrations and certain details are given.

The 1900 No. 1 catalogue of Messrs. Ludw. Loewe & Co., whose works at Berlin have been described in our last few issues, is an excellent production conspicuous for the admirable execution of the work of the printer and illustrator. The enamelled paper used throughout has been a great help to obtaining so good a result with the pictures. The catalogue comes to hand from Mr. H. F. L. Orcutt, of Farringdon Road, the London representative. A great variety of machine and other tools and apparatus for a hundred and one purposes are given more or less in detail in the book, which is handy sized, strongly bound, and of such appearance as to render it suitable for keeping on the desk or bookshelf.

Messrs. W. and J. George, Limited (late F. E. Becker & Co.), of Hatton Wall, Hatton Garden, E.C., have sent to us a number of their small lists, together with a well compiled and printed catalogue of their physical apparatus for teaching magnetism, frictional electricity, voltaic electricity, electro-magnetism, thermo-electricity, electro-plating, X-ray work, &c. This catalogue is known as Part I. (170 pages), and Parts II. and III. deal with apparatus for teaching sound, light and heat; also practical physics, mechanics, pneumatics, hydrostatics and meteorology. To attempt to mention the contents of Part I. in detail is out of the question in the small space at our disposal for these matters, but there are particularised a thousand articles of service to teachers, students and experimentalists in the directions indicated. A host of small and neat pictures are given of the different items, also some views of the works at Birmingham, and several interior photographs of the laboratories at the municipal technical and other schools for which certain apparatus was supplied by Messrs. George.

A list (No. 45) of Messrs. E. F. Moy's Acme patent switches with adjustable contacts has been sent to us.

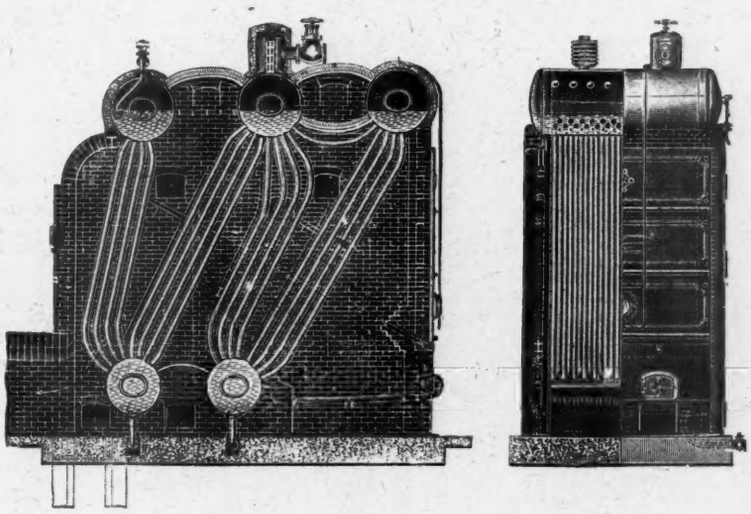
Messrs. John Gibbs & Son send us an illustrated list of their air propelling and ventilating fans (such as they have supplied for the generating station of the Liverpool Overhead Railway Company). These are direct-driven electrical dust-proof fans with enclosed motors. In the same list is shown their patent safety interlocking double-pole quick-break starting switch and resistance.

The "Engineering Price List" autumn edition (1900) has just been issued from the press by Messrs. James Truscott & Son, publishers, of Suffolk Lane, E.C. This list, which is strongly and neatly bound in thick blue covers, is a book of reference or a comprehensive engineering index made up of advertisements. There are both home and foreign editions, and these are circulated free among the chief engineers of electric lighting, tramway, and, in fact, all engineering works of importance. It has been published since 1893, and is a means of acquainting foreign and other buyers with the latest engineering productions. For shippers and export merchants it should be of service.

Circular No. 1,034 of the Westinghouse Companies contains description, with illustrations, of their direct-current engine type generators, 250 volts.

The Clay Cross Fuel Economiser.—In the economiser made by the Clay Cross Company, of Chesterfield, the external form is practically identical with the ordinary type with vertical cast-iron pipes, but internally it has some additions. One of these differences is that in a section of, say, eight pipes, the water is fed into the top of four pipes, *down* which it travels to rise up the other four pipes. This is held to prevent that corrosion which occurs in all bottom-fed economisers about the lower two feet of each pipe if the feed is cold. Another addition is that of a number of discs on a rod hung inside the pipes and leaving only a small annulus past which the water must travel quickly. These baffles are considered to break up the flowing water and prevent the deposit of scale. Probably also the discs would serve as catchers of mud. A recent writer on economisers states that with fan draught economisers have even enabled the waste gases to be delivered at only 100° F. His rule for economisers is that each 10° added to the feed is worth 1 per cent. of fuel saved. He would allow 60 to 70 pipes to a boiler capable of evaporating 450 to 500 gallons per hour, or four pipes to each ton of coal per ordinary week. A Lancashire rule is 96 pipes per boiler; another is one pipe to each 3 H.P. For chimney draught Mr. Rushton states that no economiser need be fixed unless the waste gases are at least at 450° F., and he would not reduce them below 300° F.

The Stirling Water-Tube Boiler.—This boiler, to which we alluded some years ago, consists of a pair of transversely placed bottom drums in water connection with each other and connected to three upper or steam drums by four sets of nearly vertical small tubes. Of 12 rows of these tubes only two rows are straight tubes, and all the other rows appear to differ from each other in the curvature of the tubes or their length. It is thus necessary to keep in stock 16 different patterns or lengths of tube, and this we consider a drawback. The furnace is not best placed for perfect combustion,



but it has a large combustion chamber, and there is no reason, if found necessary, why the firebrick lining should not be placed on the tubes next the fire instead of on the fourth row. On the whole, we look on the furnace as the better part of the design. Perhaps we lay more stress than we ought to upon the large variety of the tubes, but this to us is the weak point of the boiler. In its smaller sizes the number of drums and of tubes is reduced.

Electric Organ.—An organ operated on the Hope-Jones system has been fitted into the Victoria Rooms, Clifton, Bristol.

Electrical Work in Italy.—Mr. Bolton King has an interesting article on "The Position in Italy" in the last issue of the *Contemporary Review*. The following are his remarks on electrical enterprise:—"Before 1887 hardly any railway material was made at home; now almost all is produced at Milan, Turin, or Savigliano, and some is exported. Still more remarkable is the development of steam engines and electrical machinery. The great works founded by the late Signor Tosi at Legnano export electric motor engines all over the world, chiefly to South America, but also to Berlin, Vienna, Cairo, Melbourne. With the exception of

dynamos, almost all the electrical plant for home use is made in Italy, and an American company is about to start at Milan the manufacture of material for electric traction. There is a great development, too, in the making of mill machinery, agricultural implements and bicycles. The first motor car factory in the country has just been opened at Turin. Italian industry has two great assets—its rivers and its artisans. The rivers supply an almost unlimited quantity of energy for generating electricity. At present it is hardly tapped; the amount of constant supply of energy is estimated at 40,000,000 H.P., and of this not more than 2,000,000, at the outside, are used at present for any purposes. But this enormous mass of force is being rapidly utilised in North Italy. Many works, like the great steel works at Cornegliano, are driven exclusively by electricity. The Edison works at the waterfall of Paderno on the Adda supply Milan and Monza with 13,000 H.P. The generating station at Vizzola on the Ticino supplies 10,000 H.P. to the mills and factories and electric lighting of Legnano and its neighbourhood. Electric lighting has an extension in Italy undreamt of here. Electric traction is shortly to be used on the 73 miles of rail from Milan to Arona, on the branch to Varese, and on the line from Lecco to Sondrio. There is talk of adopting it for the whole of the great trunk line that runs from Rome to Reggio in Calabria. There are even beginnings of its adoption in agriculture. All the machinery, including ploughs, on Count De Asarta's farm at Trasforeano is driven by electricity."

Electrical Fire-Extinguishing Appliances.—The committee of management of the cadet-ship *Conway*, moored in the river Mersey, has just had an adequate set of modern fire-extinguishing apparatus fitted throughout the vessel; electrical appliances have been largely adopted. A set of fire pumps, with direct sea feed, supplied by Messrs. Ernest Scott & Mountain, Gateshead, is driven by an electrical motor, which, with a storage battery and connections, was supplied by Messrs. Boothroyd, Hyslop and Co., Bootle. The pumps can be started at full speed by turning a switch, and will supply water for three or four branches of hose. The supply of electricity will suffice for seven or eight hours' continuous working. The pumps can also be driven directly by the steam engine which drives the electric lighting plant of the ship, but ordinarily there will be a sufficient supply of electrical power at command to meet all likely claims which may be made on the pumps. With the disastrous fires on the two Mersey training ships, *Clarence*, in mind, the committee of the *Conway* have changed the lighting system below decks. Oil lighting has been completely abolished and an electric light system adopted. The dynamo and accumulators for this, which will suffice to supply about 200 incandescent lamps, have also been supplied by Messrs. Boothroyd & Co. This supply of electricity can be used to work the fire-extinguishing pumps if desirable. The installation of the new fire-extinguishing and lighting machinery on the *Conway* has been carried out under the supervision of Mr. J. D. Young, of Messrs. Irwin, Atkinson & Young, consulting engineers.

Improved Fan Blast.—Last Friday we attended a demonstration of the properties of a diverging discharge pipe applied to a centrifugal fan at Messrs. Capel & Co.'s gas engine works, Dalston. The discharge pipe, which is the invention of Mr. W. A. Granger, is illustrated in the figure below. It will be seen that from the outlet of the fan proper, the pipe expands uniformly to a diameter nearly twice as great as at the commencement. The effect of this construction, as strikingly demonstrated in our presence by the inventor, is to increase the discharge of air without altering either the speed or power of the fan to an appreciable extent. Experiments were carried out with a parallel pipe of the same diameter as the orifice of the fan, as well as with the diverging pipe; with the result that while the former maintained a pressure of 2 inches of water in a large box intended to represent a furnace, the outlet from which measured 7 inches by 4 inches, the latter gave a pressure of 3½ inches, or 75 per cent. increase. When the aperture in the box was increased to 10 inches by 4 inches, or 43 per cent., the pressure with the diverging pipe fell to 2 inches. A curious feature of the invention is the fact that at the small end, A, of the diverger a vacuum of 2 inches of water was found, while the pressure at the large end, B, and in the box was 3½ inches.

The importance of these results lies in the fact that with the same capital expenditure and driving power, from 30 to 50 per cent. more air can be moved in a given time; the invention is likely to be of value in connection with forced-draught furnaces (a speciality of Mr. Granger's), and other purposes requiring air under pressure.

The same principle has, we understand, been applied to water jets with even greater success. No doubt this is closely connected with the theory of the *vena contracta*; but so far as we know, the latter has not previously been applied to air blast.

The Institution of Junior Engineers.—The annual general meeting of this Institution was held on October 27th at the Westminster Palace Hotel, the retiring chairman, Mr. Basil H. Joy, presiding. There was a large attendance of the members. After the usual preliminary business, the Council's report on the work of the past year was presented and adopted. It stated that the net increase in membership had been 30, the membership roll now numbering close on 600. M. Gustave Ganet, of Paris, and Prof. W. R. Dalby, of London, had been elected honorary members. The Institution premium for the best paper read by members during the session had been awarded to Mr. E. W. Porter, Assoc.M.Inst.C.E., for his paper on "A Comparison of Railway Bridge Structures of Moderate Dimensions, and of Methods of Determining their Working Loads." Seven meetings had been held and 11 visits paid to works, apart from the visits arranged in connection with the summer meeting at Newcastle-upon-Tyne and Sunderland. Reference was also made in the report to the fifteenth anniversary dinner, and to the conversazione. The Institution had been represented at the receptions given last June by the Société des Ingenieurs Civils de France in connection with the Paris Exhibition. The scrutineers reported the election of the following new officers and members of Council:—Chairman, Mr. Percival Marshall; Vice-Chairman, Mr. Ernest King; Hon. Librarian, Mr. Lewis Rugg; Hon. Auditors, Messrs. Adam Hunter and A. W. Marshall; Secretary, Mr. W. T. Dunn; Members of Council—Messrs. Louis F. Awdes, W. Rushworth Beckton, H. Norman Gray, and W. G. Wernham; Messrs. W. B. Keen & Co. were re-elected chartered accountants. Mr. Joy inducted his successor into the chair. The proceedings closed with the announcement of the visit on November 3rd to the Millbank Street station of the London Hydraulic Power Supply Company, and of the inaugural meeting of the new session, when Sir Lowthian Bell, Bart., F.R.S., would deliver the presidential address.

Dissolution.—Messrs. F. C. Smith and J. W. Roberts, trading as Smith, Roberts & Co., at Southport and at Leigh, Lancashire, electrical engineers, have dissolved partnership, as Mr. John W. Roberts retires.

London.—The Alliance Electrical Company is to supply an engine and dynamo, switchboard, &c., for the Lambeth destructor works of the Strand District Board of Works.

New Edition.—Messrs. Whittaker & Co. have just issued a second edition of Mr. W. Perren Maycock's "Electric Wiring, Fittings, Switches and Lamps," which first made its appearance exactly a year ago.

Perth.—Messrs. Hands, Limited, are to supply various cut-outs to the Commissioners.

Rangoon.—A large rice mill has recently been equipped with an electrical installation by the G.E. Co., of Schenectady, who not long ago received a large contract for electric power transmission from the Mysore Government. On the other hand, the Oriental Telephone and Electric Company are very busy with electric light work just now, and amongst the installations on hand in Burma are two mills in Rangoon which will be fitted throughout with English machinery and material.

Trade Announcements.—We are informed that an amalgamation has been effected between the Maxim Electrical and Engineering Export Company, Limited, of Gracechurch Street, E.C., and Messrs. Edwards & Barnes, engineers, of Broad Sanctuary Chambers, S.W. This step has been taken to enable the firm to cope more easily with the very large increase of business during the last two years. The allied firms will, from October 20th, trade as the Maxim Electrical and Engineering Export Company Limited, at 65, 66 and 67, Gracechurch Street, E.C. The company has engaged Mr. Howard T. Wright, who was manager to Edwards and Barnes, to manage this department. The Maxim Company will now have very exceptional facilities for procuring raw material in the best market and of the highest quality. It is making a speciality of central electric light and power station steam accessories, including condensers, Berryman feed-water heaters, water softeners, steam and other pipe work, also economising plants to suit all circumstances where steam is used.

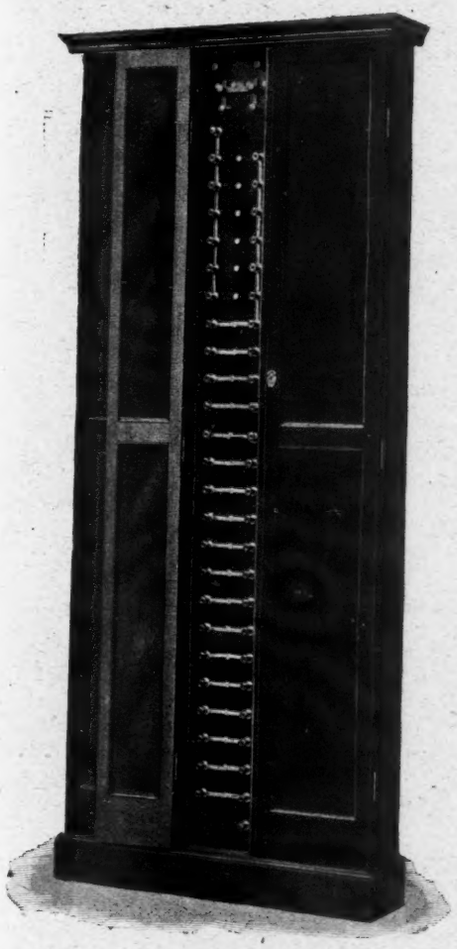
Messrs. Evered & Co., Limited, have now further increased their showrooms for the exhibition of electric light fittings at 27—35, Drury Lane, W.C., where a great display is given of the various classes of art metal work in brass, copper, hammered iron, and antique silver.

We are asked to mention that the offices of Messrs. Browett, Lindley & Co. (1899), Limited, of Sandon Engine Works, Patricroft, near Manchester, are now on the telephone (No. 2,427 Gerrard).

Mr. Samuel Hartford, A.I.E.E., notifies us that having resigned his position as secretary of Messrs. W. T. Glover & Co., Limited, he has commenced business at Salford, Manchester, as agent for the following firms:—The British Insulated Wire Company, Limited, Prescot; The Brockie-Pell Arc Lamp, Limited, London; Mr. William Rickard, Derby; and Messrs. W. N. Brunton & Son, Musselburgh.

Mr. Haydn T. Harrison, M.I.E.E., informs us that he has given up his consulting practice in order to take up the sale of certain specialities. These include electrical measuring and recording instruments manufactured by Messrs. Everett, Edgcumbe & Co., of Charterhouse Square; also street lighting specialities supplied by the Improved Glow Lamp Company. Many of the specialities to be represented by Haydn Harrison & Co. are Mr. Harrison's own invention and design, and they are up to date, and possess many novel features.

2,000-Volt Storage Battery.—We recently had an opportunity of inspecting a storage battery designed for the testing of electrical apparatus at high pressures—up to 2,000 volts—in steps of 80 volts. The cells, which are of very small dimensions, are connected in sets of 40 elements, and mounted on trays; these are arranged in cupboards, on either side of the switchboard, as shown in our illustration, and can readily be removed for examination, &c. The switch-gear consists of about 50 small two-way switches operated by insulating handles, and so arranged, as in the familiar mercury-cup boards, that any number of the groups can be arranged either in series or in parallel as desired. Suitable stops are provided so that by no possible means can the switches be set so as to short circuit any of the cells. A separate two-way switch at the top of the board connects the battery either to the test terminals, or through a glow



lamp to the charging terminals; the battery is to be charged with all the groups in parallel, off a 100-volt circuit, and the interposition of the lamp provides at once the required resistance and an efficient safeguard against accident through throwing the battery in *series* on the charging circuit. The whole equipment was made by Messrs. Niblett, Sutherland & Marcuson, of Chandos Street, W.C., the cells used being a modified form of their patent accumulator. The special feature of the latter is its solidity of construction, the active material being held in place by thin ribbed plates of porous ware, which renders this type of cell particularly suitable for all purposes calling for portability and long life. There is practically no free liquid space, so that disintegration of the active material produced by the "wash" of the acid is eliminated, while the resistance of the cells is hardly affected. The same firm has lately introduced a very neat little variable resistance of the compression type, which gives a perfectly uniform variation over a wide range, as well as a simple charging board for small batteries, which at once shows the direction of the current, and provides a resistance to control its strength.

ELECTRIC LIGHT AND POWER NOTES.

Aberavon.—The T.C. has resolved to petition the B. of T. for a prov. order for the supply of electricity within the borough.

Ashford.—Owing to the increasing demand for electric light, the Corporation contemplates extending the electricity works and plant at a cost of £13,000.

Austria.—The Vereinegte Electricitäts Gesellschaft, of Vienna, has secured a contract for the establishment of a municipal central electric lighting station in the town of Bendenz (Vorarlberg). Water power is to be utilised, the generating plant to be at first put down, comprising three multiphase dynamos of 400 H.P. each.

Batley.—Mr. Sandford Fawcett, inspector of the L.G.B., sat at Batley last week to hear an application of the T.C. for sanction to borrow £25,602 for the supply of electric light and power within the borough. It was shown that electrical energy was required for both purposes, seeing that the Corporation had in contemplation the construction of tramways for connecting the outlying districts with the centre of the town. These tramways had already been authorised by a provisional order, which was confirmed in the last session of Parliament. Mr. Clirehugh is the electrical engineer. There was no opposition.

Beverley.—At a special meeting of the Town Council last week it was resolved that application be made to the B. of T. for a prov. order to supply electricity within the borough.

Bridge of Allan.—A deputation from the burgh of Bridge of Allan has had an interview with a Sub-Committee of the E.L. Committee of Stirling regarding the introduction of the electric light to Bridge of Allan, with current supplied from Stirling.

Bristol.—Last week the Electrical Committee considered the report of Sir Benjamin Baker on the question submitted to him as to the desirability of strengthening the foundations of the new electric station by cross walls, as proposed by the architect, Mr. H. Williams. The engineer recommended a modification of the plans, and that the foundations should be strengthened by buttresses instead of cross walls. In recommending this, he pointed out that the buttresses would involve less expenditure than walls, and would achieve the object in view. Mr. Williams undertook to carry out Sir Benjamin Baker's suggestion.

Canterbury.—At a meeting of the Lighting Committee last week, it was decided to recommend the Council to apply for sanction to raise a further loan of £13,000 for the purpose of enlarging the electricity works and extending the plant. The total amount of the additional outlay will eventually be £21,000, but for the present it is proposed to carry out only a portion of the scheme.

Chelmsford.—The Lighting Committee last week recommended the T.C. to pay the E.L. company's account for public lighting during the last quarter, amounting to £266. The Finance Committee, however, complained of the unsatisfactory nature of the lighting service, and the report was referred back.

Darlaston.—The Midland Power Corporation has notified the Darlaston D.C. of its intention to lay down a cable for an electric supply in Darlaston.

Dewsbury.—A L.G.B. inquiry was held at Dewsbury last week by Colonel Marsh, an inspector of the Board, the Corporation having applied for powers to borrow £4,500 and £3,000 to carry out extensions of their electricity works. There was no opposition. It was proved that new works were required, and that additional cables and other plant had had to be obtained; the latter of the two sums was required for extensions not yet asked for, but which the borough electrical engineer said would be needed before the end of 1902.

The electricity works, which were opened in 1894, have already been considerably extended. The engine room has now been extended to 86 feet long and 32 feet wide. A new battery room has also been erected. There are three Lancashire boilers working at 150 lbs. per square inch, and two of them are fitted with Sinclair's mechanical stokers. A Green's economiser and a Babcock and Wilcox feed water heater are fixed in addition to the necessary feed pumps. All the engines in use have been supplied by Messrs. Willans & Robinson, Rugby. The total indicated horse-power is now 1,045, as compared with 480 when the works were started. The generating plant originally was of 250 KW. capacity. Now it is 500. A double-ended steam balancer of 30 KW. has been recently supplied by Messrs. Crompton, and two sets of 110 KW. each by Messrs. Bruce Peebles & Co., Edinburgh. A motor-generator has also been added to the plant. The original battery consisted of 130 cells, having a capacity of 400 ampere-hours. An additional battery has been fixed of the same capacity. A new switchboard has been erected, and from this the mains are taken below the floor and fixed to the walls of a tunnel which runs under the whole length of the works. The supply pressure has been changed from 110 volts to 220 volts, this necessitating a great deal of re-arrangement and alteration of the generating plant. Important extensions have been made to the distributing cables. Under the original contract 5¼ miles of cables were laid. There have since been laid 13¾ miles. The recent extensions have been carried out partly with a view to supplying the British Electric Traction Company with energy for trams which they propose to run in the district. There are two machines fixed

during the session had been awarded to Mr. E. W. Porter, Musselburgh.

suitable for this purpose, though they are at present used for lighting. Last year the works made a profit of £201, as against a deficit of £477 on the previous year's working. There are now 192 consumers, as compared with 101 2½ years ago. Mr. O. M. Jonas is the engineer. He took charge of the works in May, 1898, and since then the undertaking has made great progress. During the year ended March 31st last, the units sold were 194,622, receipts, £4,031. The Brighton system of charging is in use.

Dublin.—The E.L. Committee meets to-day to appoint an electric inspector.

Dudley.—On the 5th inst., appropriately enough, the town of Dudley was illuminated with electricity for the first time. The sum of £33,000 has been borrowed to carry out the scheme, and a further amount of £10,000 is to be raised for wiring buildings. The price to private consumers is 6d. per unit for two hours per day, and 1½d. afterwards, and the output is estimated at 270,000 units per annum.

Falkirk.—At a special meeting of the T.C. on Monday evening it was decided to make application to the B. of T. for a prov. order for electric lighting, in view of the determination of two private companies to apply for prov. orders. It was pointed out that after obtaining the prov. order, the Council might negotiate with a company to supply electricity, if they did not do so themselves. Mr. Ronald (burgh surveyor) was appointed engineer for the order.

Faversham.—The T.C. has decided to apply to the B. of T. for a prov. order for electric lighting.

Gloucester.—Having considered a report on the extension of arc lighting, drawn up by the city surveyor and Mr. Bache, electrical engineer, the Electrical Supply Committee last week recommended the Council to erect eight lamps as soon as possible at an estimated cost of £400. Other extensions are to be carried out as opportunity serves, the whole cost being estimated at £3,000. The Council agreed to the proposal.

Leigh.—Mr. G. W. Willcocks, inspector of the L.G.B., held an inquiry at Leigh last week into the application by the T.C. to borrow £5,000 for electric lighting extensions. The town clerk said the application was for sanction to a loan of £5,000 to extend the feeders and distributors to thickly-populated districts. The electricity works were completed in January last. Sanction had been given to a loan of £10,216, but £10,546 had been expended on capital account up to the present time. The number of consumers at present was 67, and the number of private 8-c.p. lamps was 3,766. There was no public electric lighting at present. There was no opposition.

Littlehampton.—The Highways and Lighting Committee recently reported that a letter had been received from the North British Electric Supply Company, intimating their intention to apply for Parliamentary powers to supply electrical energy in the district.

London. — Bermondsey. — The Vestry on Monday approved a drawing for arc lamp-posts, and resolved to issue advertisements inviting tenders for the supply of the standards for public lighting purposes.

Brixton.—It is no unusual event for an electricity works which has been saddled with a dust destructor to cut the connection with pleasure; it is, however, a novelty for the destructor to be barred by order of the Court. At Lambeth police-court last week the Vestry summoned the South London Electric Supply Corporation, Limited, in respect of an alleged nuisance arising from the burning of refuse at their works. It appeared that the company, at the time they took over the electric lighting order from the Vestry, entered into a contract with that body, under which they agreed to take the household refuse collected by the Vestry and destroy it in destructors which the company erected for the purpose, the heat generated by the destruction of the refuse being used for the production of steam power for the electric lighting works. Subsequently an agreement was entered into by which the company were bound to pay the Vestry certain compensation in the event of the corporation refusing to continue to receive the parish dust. For some months past the inhabitants of the district surrounding the works have been complaining of the nuisance caused by the burning of the refuse, their complaints being under three heads—first, the smoke; secondly, the dust and ashes blown into the gardens and houses; and, thirdly, the stench arising from the combustion of the refuse. Finally, the inhabitants made a formal complaint to the Vestry, who thereupon instituted these proceedings. The complaint of the Vestry was that the Corporation had not taken the best practicable means of abating the nuisance and for preventing and counteracting the effluvia.

Mr. Wontner pointed out that the company were liable to a penalty if they did not take the Vestry's refuse. What were they to do with their contract?

Mr. Hopkins: Tear it up and pay the penalties. What business has an electric light company to cause effluvia?

Mr. Wontner: I might as well retort by saying, "What right has the Vestry to force the company to burn their refuse?" The company had been doing their best to stop the effluvia by using the best possible means of consuming the dust.

After some further discussion, the summons was adjourned upon the understanding that the burning of the refuse would be discontinued.

The South London Electric Supply Corporation have decided to waive their charges for meter rentals in the case of all places of public worship.

London Docks.—The new electric light installation for lighting the London and St. Katharine Docks was inaugurated last week by the chairman, Mr. C. J. C. Scott, in the presence of a party of directors, including the chairman of the Works Committee (Colonel du Plat Taylor, C.B.), the manager (Mr. H. W. Williams), the engineer (Mr. C. E. Vernon), the electrical engineer (Mr. Stanley Bright, M.Inst.E.E.), the resident engineer, the superintendent and others. After switching on at the generating station, which is situated at the Hermitage entrance to the London Dock, the party visited the spacious wool warehouses, as well as the Jetty, London Dock, and the several offices connected therewith. The party also visited the St. Katharine Dock warehouses and quays. The illuminating power for lighting the above is equal to 4,000 lamps of 8 c.p. each. The various stowages and show floors were adequately lighted for working throughout, and men were engaged in all the said warehouses, laying down wool for the present series of sales. Satisfaction was expressed by the warehousekeepers and the men generally with the brilliancy and uniformity of the light. The generating plant consists of three Galloway boilers with mechanical stokers, and three sets of Belliss-Crompton engines and dynamos, each set being capable of supplying the current for 2,000 8-c.p. lamps. The wiring is carried out on the three-wire system with a pressure of 220 volts on either side of the middle wire. The mains are of hard drawn bare copper mounted on oil insulators, and are run over the warehouses. The seating of plant and running of mains, wiring, &c., has been effected by the Joint Committee's engineering staff. In addition to the warehouses, &c., already mentioned, current is supplied to many of the other warehouses at the docks.

Mitcham.—The P.C. has asked the Croydon R.D.C. to obtain a prov. order for electric lighting at Mitcham.

Neath.—At a meeting of the T.C. held last week, it was unanimously resolved to apply to the B. of T. for an E.L. prov. order for the borough.

New Power Schemes.—According to the *North-Eastern Daily Gazette* an important scheme for the electrical distribution of power for manufacturing and other purposes throughout the Middlesbrough, Stockton, Hartlepool and Cleveland district is being arranged, and a Bill applying for the necessary Parliamentary sanction will be introduced next session. The scheme, which has the support of many of the most influential manufacturers in the district, will be on similar lines to the Lancashire, South Wales and Durham District Power Bills, which were passed last session. Mr. A. A. Campbell Swinton, M.Inst.C.E., of Westminster, is the engineer to the new scheme.

Newport.—The Electricity Committee of the T.C. has recommended that a system of free wiring be adopted at Newport, under which the Corporation should undertake, where requested, the wiring of private houses and shops up to an expenditure on the installation of private premises of £20, and above that sum in special cases. Local contractors are asked to tender for this work, and a sum of £2,000 out of a new loan is to be allocated to the purpose.

North Metropolitan District.—With regard to the proposal for making a joint application to Parliament for powers to provide electrical energy for lighting and other purposes, an agreement has been drawn up and sealed by all the local authorities concerned, excepting Wood Green. At a recent meeting of this authority the agreement was submitted to be sealed; but Mr. Littler, C.B., Q.C., the chairman, refused to put it to the vote on the ground that the agreement was illegal from end to end. Mr. Littler said it was a "wild cat" scheme, and it was his duty to prevent the sealing of an agreement which, if acted upon, would render each member of the Council liable to be surcharged. After a very animated debate, Mr. Littler consented to the sealing of the first four clauses of the agreement, and a resolution to this effect was carried. The matter has been submitted to the other authorities, which are now holding special meetings on the subject.

Otley.—The U.D.C. has resolved to instruct Mr. G. Wilkinson, of Harrogate, to report on the question of the electric lighting of the town.

Paignton.—At a meeting of the D.C. on Monday the chairman announced that Mr. Paris Singer had offered to lay down an electricity works to supply the central parts of the town, and to give the town the option of purchase within a reasonable time at exactly the price it cost him. The Council cordially approved, and authorised the E.L. Committee to report on the matter.

Perth.—At a committee meeting of Perth Police Commissioners, a letter was read from the Secretary for Scotland consenting to the city borrowing £43,000 for the electric lighting of the city. Some time ago the Commissioners sought permission to borrow £100,000, £50,000 being for gas purposes, and £50,000 for electric lighting. The Secretary has reduced the electric lighting by £7,000.

St. James's Palace.—The Chapel Royal is to be lighted in future by electricity. The installation is likely to be completed within the next fortnight.

Stafford.—The T.C. having applied for leave to borrow £10,000 for purposes of electric lighting, Mr. H. P. Boulnois, M.I.C.E., L.G.B. inspector, held a public inquiry last week. There was no opposition to the application. The town clerk said the estimated population to date was 22,140, the annual assessable value of the borough for district rate was £70,332, and the outstanding loans

on September 30th amounted to £253,604. The money required for the extension of the mains was £3,500, and for additional plant £6,500. In the last six months they had generated more electricity than in the whole 12 months before. They had borrowed £20,000 for purposes of electricity, and it had all been spent but £50; whilst £2,462 had been repaid. Mr. Pooley, manager of the gas and electricity department, stated that the demand for electricity had increased enormously compared with the corresponding six months of last year, when they generated 33,369 Board of Trade units. In the same period of this year they had generated 100,733 units, an increase of over 200 per cent. One consumer alone was taking practically their total output of last year for charging accumulator cells. The present capacity of the plant was 198 KW. Their maximum load would this year be 170 KW., so that they would be running very near to their total capacity. They had three engine dynamos of 66 KW. capacity each; the one proposed to be added would have a capacity of 200 KW. They also required about 4,600 yards of additional mains.

Todmorden.—At a meeting of the T.C. last week, a lengthy report was presented on electricity for lighting and motive power in the district. The Council decided to give notice of its intention to apply for a prov. order to supply electricity for all purposes within the borough.

Walmer.—Last week the D.C. discussed the proposals of Messrs. Foote & Milne anent the lighting of the streets by electricity, from which it was gathered that on a capital outlay of £60,000, the purchase price at the end of five years would be increased by £13,000. The Council decided to leave the matter in the hands of the Electric Lighting Committee to confer with Deal authorities.

Walton.—The D.C. has resolved to disapprove of the application by Edmundson's Electricity Corporation, Limited, to the B. of T. for a prov. order, and is considering the question of applying for one itself.

Wellington.—The U.D.C. last week decided to apply to the B. of T. for a prov. order to supply electricity for all purposes within the district; and Mr. T. L. Miller, of Liverpool, was appointed consulting engineer.

Wolverhampton.—At a meeting of the T.C. last week the E.L. Committee's report, a summary of which appeared in the last issue of the ELECTRICAL REVIEW, was agreed to. The additional outlay, required up to the end of 1902, to carry out the Committee's recommendation, will include extensions to buildings and additional engine foundations, estimated to cost £4,620; six 600-H.P. steam boilers, with feed pumps and piping, economisers and superheaters for 12 boilers, steam piping, &c., water storage and softening plant, and induced draught apparatus for 12 boilers, estimated to cost in all £18,140; two 500-KW. steam dynamos, condensers and circulating pumps for four engines, travelling crane, switchboards and storage battery for tramways, estimated to cost £19,580; feeders, meters, distributors, &c., £15,000; making, with the amount overspent on the original loan, £1,602, a total cost of £58,942.

Wrexham.—Negotiations are in progress between Mr. Trentham, consulting engineer to the T.C., and the National Electric Traction Company, as promoters of the electric tramways, with a view to the supply of electricity for traction from the Corporation's electricity works.

ELECTRIC TRACTION NOTES.

Cardiff.—On Monday a joint meeting of the Electrical Tramways and Lighting Committees considered Alderman Carey's suggestion that the efficiency of both services would be improved and economy to the rates effected by the two concerns being placed under the control of one committee. The following resolution, proposed by Councillor Wm. Evans, was unanimously adopted:—

That, in order to avoid the necessity for building a third power station, the tramways engineer and the electrical lighting engineer be desired to report separately as to how the power station (tramways) at Roath and the existing station can be utilised for supplying additional current for lighting and traction purposes, the date when such current will be available, and the price thereof.

The T.C. last week considered the Tramway Committee's proposal to allow Mr. Ellis, the traction engineer, to appoint his own deputy, at a salary of £225. By 16 votes to 4 it was resolved not to consent to this, and it was also decided to issue advertisements in the ordinary way.

Dartford.—The U.D.C. held a special meeting on Friday, at which it was resolved to obtain powers from the Board of Trade to construct light tramways throughout their district.

Dublin.—The Recorder, at the City Sessions of Dublin his week, awarded a decree of £50 to Mrs. Elizabeth Roberts, a nurse, who sued the Dublin Tramway Company for injuries sustained by her by having been thrown off an outside car on the North Strand Road, the horse having slipped, it was stated, owing to the non-sanding of the tramway tracks by the company. The Recorder said the non-sanding of the streets was a notorious danger to the citizens of Dublin. The Corporation and the Tramway Company stood looking at each other, saying it was the other's business, and meanwhile down went the horses. He himself had to sell a pair owing to injuries they had received by slipping up. The period of the non-sanding unfortunately coincided with the introduction of the splendid and swift service of electric trams.

Germany.—The Ulm Electricitäts Gesellschaft propose to establish services of electric road vehicles in those parts of the town of Ulm not provided with tramways, to act as feeders to the tramway system.

Gourock.—The Corporation have accepted tenders to the amount of £25,000 for the laying of the track along the river front suitable for the overhead system.

Holland.—A contract for the construction of a light electric railway between Scheveningen, the Hague, and Rotterdam has been secured by Messrs. Siemens & Halske, of Berlin. The line, which is being built for the Zuid Hollandsche Electrische Spoorweg Maatschappy, has to be completed and ready for traffic by August, 1903.

The Lakes.—The Lake District electric tram scheme from Bowness to Windermere and Ambleside was only shelved for a time. The promoters now intend to try and meet the views of the various Councils as to road widening, so that they will be in a position to submit new plans and advertise a fresh scheme for the next session of Parliament. If the roads are widened to 30 feet, the objections of Lancashire and Westmorland County Councils will fall through.

Liverpool.—A largely-signed memorial from property owners and residents in Seaforth, Liverpool (North), was submitted at the monthly meeting of the Waterloo District Council on Monday, urging the Council to use every effort to prevent the Liverpool Corporation from carrying an electric tramway along Seaforth Road, in connection with the Liverpool system of electric tramways. In the memorial it was said:—"They (the electric cars) were not needed, and would be a source of great danger." Councillor Beaver moved that the memorial be referred to the Tramways Committee. He said that in Liverpool a great number of memorials were presented against tramways being constructed, but after the tramways were made the people were very pleased with them. Finally, the memorial was referred to the Tramways Committee. The surveyor reported that the contractor's account for the reconstruction of Crosby Road was £18,141 11s. 10d. Of this sum £3,670 9s. 9d. was for tramway track.

London County Council.—The Council decided on Tuesday, subject to the Wandsworth local authority consenting to the proposed tramway from High Road, Tooting, to the county boundary at Waterfall Bridge, and agreeing to contribute one-third of the net cost of the necessary street widenings, to apply to Parliament for powers to widen Merton Road in connection with the construction of the projected tramway.

Merthyr.—The *Western Mail* says that last week Mr. W. R. Sheldon was conducting an arbitration at the Inns of Court Hotel, London, upon a dispute between the British Electric Traction Company and the Merthyr Urban District Council in relation to the new light railways.

Mitcham and Croydon.—The Parish Council has passed a resolution asking the Croydon R.D.C. to make application for a provisional order for the construction of light railways in the parish. The Parish Council at first applied to the L.C.C. for an extension of their tramways, but were referred to the R.D.C. as being the local tramway authority.

Plymouth.—A report presented to the Electricity Committee with reference to the breaking of one of the overhead wires on the Prince Docks tramways on 23rd ult. states that the accident occurred during the trial trip of one of the new cars. The Westinghouse Electric Company have been informed that they will be held responsible for the damage, and for any claims that may arise in connection with the mishap.

Rhyl.—The U.D.C. has placed orders with the makers of the boilers for additional machinery, in order that they may be able to generate the electric current required for working the new tramway. The town clerk is to apply for the necessary additional loan to cover the cost, £15,000 having already been granted.

Vienna.—On the morning of the 1st inst., at Vienna, a telephone wire broke and fell upon an electric tramway overhead conductor (500 volts). An elderly lady received a severe shock, and three people who incautiously or ignorantly went to her assistance suffered likewise. Two of them had to be conveyed to hospital, the others being able to return home after treatment.

West Bromwich.—The agreement between the T.C. and the British Electric Traction Company, whereby the latter are granted a 21 years' lease of the tramway running through West Bromwich, has now been signed by both parties. One of the terms is that the present 1d. stages are to become ½d. stages. The other terms have been published in the ELECTRICAL REVIEW.

Wolverhampton.—In the issue of the ELECTRICAL REVIEW of last week appeared a summary of an important report issued by the Tramways Committee of the Corporation. This report was adopted at the meeting of the Town Council on Wednesday.

On 2nd inst., in the Chancery Division, before Mr. Justice Joyce, Mr. Thompson made an application in the case of the Wolverhampton Corporation *v.* the British Electric Traction Company, Limited. He said the case stood at present two out of

public worship.

mated population to date was 22,140, the annual assessable value of the borough for district rate was £70,332, and the outstanding loans

the present list. He appeared for the defendant company, and the action was one for the specific performance of an agreement for the sale of certain tramways, and the substantial question in dispute was whether under certain Acts and provisional orders the defendant company were entitled to have running powers over certain of the Wolverhampton tramways. It was decided that the case should be taken on Wednesday, subject to any part heard case.

Wigan.—The T.C. is to apply for powers to extend the tramways along the remaining unoccupied highways of the borough. The B. of T. is to be asked to sanction the borrowing of £18,250 for the purposes of the undertaking.

TELEGRAPH AND TELEPHONE NOTES.

Telegrams to the Far East.—Arrangements have been made for facilitating and cheapening telegraphic communication with Her Majesty's Military and Naval Forces on active service in China. The Eastern, Eastern Extension, and Great Northern Telegraph Companies have undertaken to transmit telegrams to and from officers and men at half rates, that is, at 2s. 9d. a word instead of 5s. 5d.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
South American:—		
Pará-Maranham	March 1, 1900	
Ceará-Maranham	Feb. 20, 1900	
Paramaribo-Cayenne	Oct. 6, 1900	
Barcelona - Guanta - Cumana - Porilamar - Carupano (Venezuela)	Nov. 1, 1900	
West Indian:—		
Mole St. Nicholas-Cape Haitien	March 6, 1900	
African:—		
St. Louis (Senegal)-Bathurst	Aug. 25, 1900	
Zanzibar-Mombassa	Sept. 29, 1900	
Latakia-Cyprus	June 20, 1899	
Landlines:—		
Chinese:—		
Tientsin-Pekin	June 12, 1900	
Pekin-Kalgan	June 14, 1900	
Kalgan-Maimatchin	June 30, 1900	
Tientsin, *via* Shanghai	June 16, 1900	
Tientsin-Niuchwang	June 18, 1900	
South American:—		
Communications with all offices of Colombia beyond Buenaventura	January 22, 1900	
Ecuador landlines	March 13, 1897	
Landlines south of Serena	July 20, 1900	
Higuerote-Barcelona (Venezuela)	Oct. 30, 1900	Nov. 1, 1900.
Landlines west of Barquisineto and Coro	Nov. 1, 1900	
Barcelona (Venezuela)-Ciudad (Bolivar)	Nov. 1, 1900	
Communication "*via* Hanekino" interrupted on Persian territory	Feb. 24, 1900	
All lines connecting Cochin China with Thuanan	Oct. 23, 1900	
Communications between Saigon and North Annam and Tonkin	Oct. 23, 1900	
Majunga-Tananarive	Nov. 6, 1900	
Blagowestschensk-Chabarovsk	Nov. 7, 1900	

Telephone Wires in Germany.—Operations have been commenced on the placing of all the telephone wires in Dortmund underground in place of overhead.

Wireless Telegraphy.—According to the *Times* the practicability of utilizing Marconi's system of wireless telegraphy in connection with the mail packets running between Dover and Ostend was tested on 4th inst. with satisfactory results. The vessel selected for the demonstrations was the Belgian mail packet *Princess Clementine*, commanded by Captain Romyn. The installation was fitted up in one of the private deck cabins on the starboard side. The receiving and sending wires were connected to the foremast, the height of which had been considerably increased. The land installation was set up at La Panne, on the flat coast between Ostend and Dunkirk, the mast being about 130 feet in height. The distance between La Panne and Dover is 61 miles. The *Princess Clementine* left Ostend soon after 11 o'clock on Saturday night and arrived at Dover at 2.40 next morning. Capt. Romyn described the results as far beyond anything which the Belgian authorities had anticipated. A message was transmitted from Ostend to La Panne when the *Princess Clementine* left the Belgian port, and telegrams continued to be exchanged between the vessel and the shore at frequent intervals during the voyage to Dover. The messages were transmitted at the rate of about 20 words per minute. Messages were exchanged right up to the time the vessel reached Dover. Before the *Princess Clementine* left Dover on Monday morning a wireless message was transmitted to Belgium stating the number of passengers on board.

On Monday some further demonstrations of the value of wireless telegraphy were given on board the *Princess Clementine* while on her voyage from Ostend to Dover. For some time past the Marconi Company have had a station at Dovercourt, Essex, and when the *Princess Clementine* was about half way on her voyage the operators on board sent a message to the Dovercourt station. A reply was received asking the *Princess Clementine's* bearings, which were reported. A number of other messages were sent during the journey.

A press dispatch from Gibraltar says that wireless telegraph stations are to be established there and at Malta.

CONTRACTS OPEN AND CLOSED.

OPEN.

Belfast.—November 23rd. Tenders are invited for steam pipes, pumps, condensing plant, boilers, mechanical stokers, superheaters, coal and ash conveying plant, and switchboard extensions for the Corporation electricity works. See "Official Notices" October 12th.

Bristol.—November 22nd. The Electrical Committee wants tenders for an electric travelling crane and condensing plant. See "Official Notices" to-day.

Cardiff.—November 28th. The Corporation wants tenders for a 75-kw. motor generator, Tudor battery, lead covered cables, and a 20-ton travelling crane for the tramways undertaking. See "Official Notices" to-day.

Farnworth.—November 12th. The U.D.C. wants tenders for "free wiring." See "Official Notices" November 2nd.

Greenwich.—November 22nd. The Guardians want tenders for the electric lighting of the new workhouse now erecting. See "Official Notices" November 2nd.

Halifax.—The Tramways and Electricity Committee wants tenders for various sized underground cables. See "Official Notices" November 2nd.

Harwich.—November 17th. Tenders are being invited for gas engines, dynamos, cables, battery, lighting and traction switchboard, track laying, and traction equipment, &c. See "Official Notices" November 2nd.

Ilford.—November 12th. The U.D.C. invites tenders for free wiring. See "Official Notices" October 26th.

Kendal.—November 25th. The Corporation wants tenders for complete electric lighting station equipment (boilers, steam dynamos, battery, &c.); and for underground mains, meters and services. See "Official Notices" November 2nd.

Lincoln.—November 15th. The Corporation wants tenders for a dryback marine-type boiler; a high speed engine coupled to a C.C. dynamo; pump and motor and accessories.

London.—November 10th. The Streets Committee of the Corporation wants to hire a mechanically driven dust cart. See "Official Notices" October 5th.

London.—November 13th. The L.C.C. wants tenders for about 150 arc lamps (80 10—12 amperes and 70 5—6 amperes) for the lighting of the Victoria Embankment and Westminster Bridge. See "Official Notices" October 26th.

London.—November 22nd. Tenders are invited for the wiring of the Central Finsbury Radical Club. See "Official Notices" to-day.

Manchester.—November 9th. The Tramways Committee wants tenders for the supply of cast-iron bases for tramway poles. See "Official Notices" November 2nd.

Newcastle-on-Tyne.—November 21st. The New Tramways Committee wants tenders for arc lamp cables, telephone and pilot wires. Specifications from Mr. Charles Hopkinson, consulting engineer, 26, Victoria Street, S.W.

Stavanger.—January 2nd. Tenders are invited by the Stavanger Corporation for the establishment of electrical communication or transmission of power from the Altesrig Waterfalls to Stavanger, a distance of about 39 kilometres, in accordance with the plans of a civil engineer named Schoien. Tenders must be received by January 2nd, 1901. Further information may be obtained on application direct to Mr. E. Berentsen, British Vice-Consul, Stavanger.

Stockport.—November 24th. The Tramways Committee wants tenders for the construction of permanent way, excluding bonding and paving, for about 2½ miles of double and 2¼ miles of single track. Mr. J. Atkinson is the borough surveyor.

Stockport.—November 24th. The T.C. wants tenders for the laying of permanent way for electric tramways. Also for the supply of 1,050 tons of girder rails, 90 tons of fishplates, 25 tons of tie bars, various points, crossings, bolts and nuts, &c. See two "Official Notices" to-day.

Stockport.—November 24th. The T.C. wants tenders for the overhead equipment, and supply of rail bonds, for six sections of electric tramways. See "Official Noaices" to-day.

Walker.—November 12th. The U.D.C. wants tenders for the erection of a 2-unit Meldrum destructor, including boilers, steam pipes, &c. See "Official Notices" October 26th.

West Bromwich.—November 17th. The Corporation wants tenders for wiring materials, motors, and labour in wiring for lighting and power installations. See "Official Notices" this week.

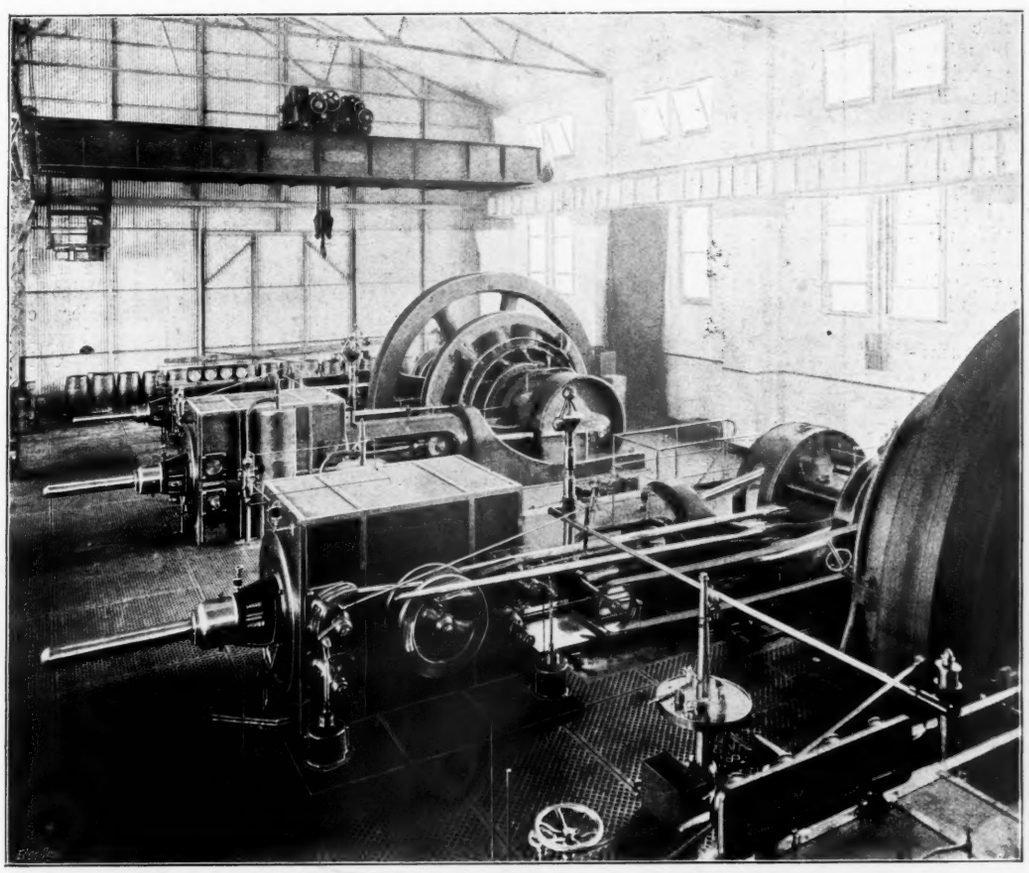
(*Continued on page* 753.)

ELECTRIC TRAMWAYS IN SYDNEY (N.S.W.)

By ARTHUR C. F. WEBB.

The development of electric tramways in New South Wales has been very gradual, commencing in 1890 with a small experimental line from Randwick to Waverley, where there had been a steam line which had never been able to pay its way. Its short-radius curves and steep grades on the curves formed a severe trial even for electric traction, and, moreover, the traffic was small. The experiment was discontinued, and eventually the material was taken over to the North Shore and re-erected as an extension of the cable tram, from the cable terminus to Middle Harbour. From that time until recently the application of electricity was confined to the north side of the harbour, lines being run to Mosman's Bay and Willoughby. Then came the Rose Bay line, an extension of the Ocean Street cable line, and finally the work was put in hand for a tramway down Sydney's principal thoroughfare, George Street, intended as a trial line to prove whether or no electric traction was suitable for the tramway system as a whole, with an ultimate view of converting all the steam tramways to electric traction. Before the plans were far on the way it was practically decided by the Railway Commissioners that electric traction was the best and most economical system to adopt, and provision was therefore made that the power house then being planned for George Street only, should be arranged for extensions to supply the whole of the system with power for electric traction.

The power house is situated at Ultimo, close to the railway, from which a special siding is run, and not far from Darling Harbour, from which the supply of water for condensing purposes is obtained. Ample provision is made on the site for future extensions, the building being arranged with the offices, &c., in front, and engine house and boiler house side by side behind the offices. The engine room is at present 100 feet wide and 100 feet long, and the boiler room 85 feet wide and the same length as the engine room; both are capable of extension longitudinally to an extreme length of 500 feet. The building is lofty and well-lighted, and in no way cramped.



Ultimo Engine Room (Looking from Switchboard Gallery).

The machinery at present erected is intended to provide power not only to the George Street and Harris Street section, but also to the North Shore lines and the Dulwich Hill, Newtown, and St. Peter's lines. There are four sets of generators, each of 850 kw. capacity, consisting of General Electric multipolar generators, direct connected to Allis compound horizontal engines, arranged in two rows. The engines have 26-inch and 48-inch cylinders with a stroke of 4 feet, and run at 100 revolutions; they are made alternately right and left handed, so that one condenser may serve for two engines. The generators have 12 field-poles, the armatures being drum-wound in slots, and weighing about 21 tons each; the 20 feet fly-wheels are compound, the rims being reinforced with steel plates, and weigh about 40 tons.

F

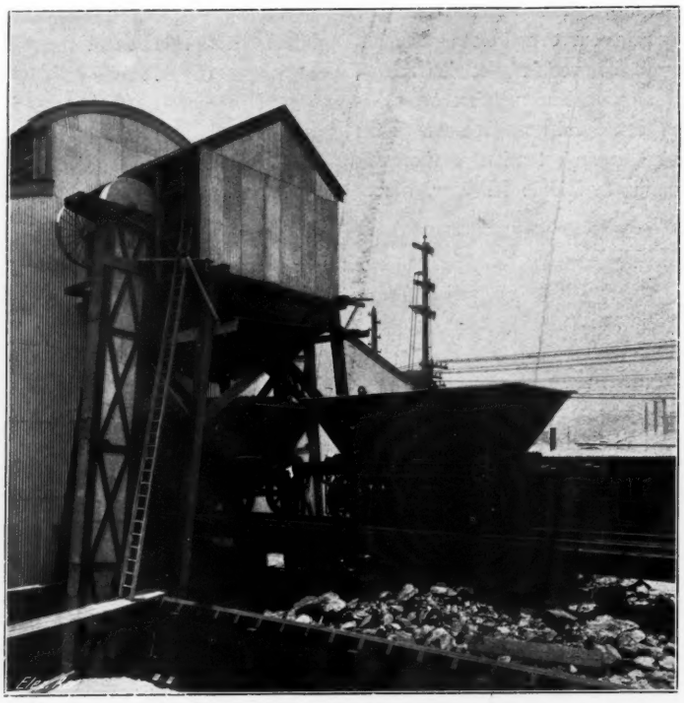
stations are to be established there and at Malta.

(Continued on page 753.)

The boilers are also in two rows; at present 14 are installed. They are multitubular, of 300 H.P. each, 16 feet long, and 7 feet in diameter, with 72 tubes of 4 inches diameter, 22 of which are stayed, and 50 plain, and six stays are used in the steam space; the boiler settings are fitted with Alvés patent hot-air economisers. The circulating pumps are Blake centrifugal, and the feed pumps Blake three-throw plunger, all electrically-driven, and the air-pumps for Wheeler condensers are Blake steam-driven. There are two travelling cranes, one over each row of generators, with a span of 48 feet; each motion is controlled by a separate motor; General Electric standard 800 railway type are used for travelling and hoisting, and a 25 H.P. General Electric L.W.P. type for traverse, all motors being series wound with rheostatic control. The lifting capacity of the cranes is 30 tons.

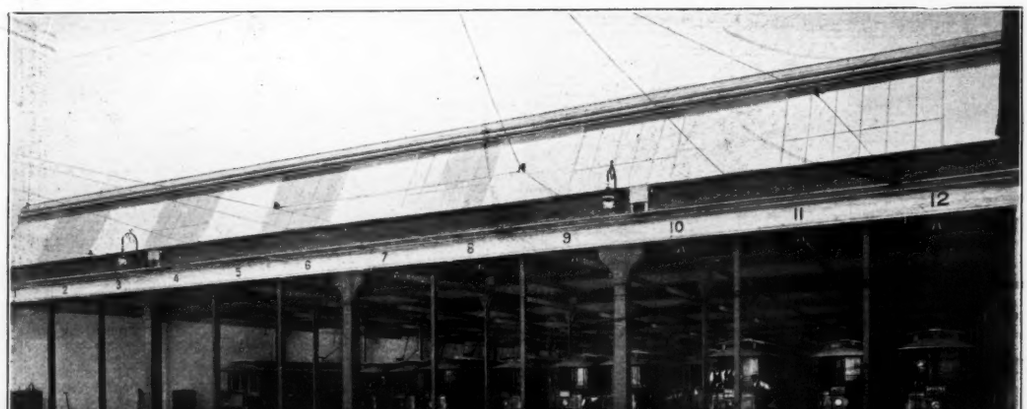
The accumulators consist of 300 K. 23, and 300 K. 9, E.P.S. cells.

The George Street and Harris Street lines are equipped with centre-pole construction, except at one end of George Street, where the width of the thoroughfare did not admit of it. Mannesmann steel poles are used with iron brackets and cast-iron ornamental bases and fittings, set in concrete with a trachyte protective kerb, the track being laid with 7 feet centres. On the existing lines, when converted by the Railway Commissioners, span wire construction has been adopted principally on account of expense.



Coal Elevator, Ultimo.

The feeder cables for George Street are placed underground in Callender-Webber casing, laid partly under the footpath and partly under the roadway between the tracks, brick pits being employed for junction boxes, with cast-iron draw boxes. The brick pits are 4 feet × 3 feet and 5 feet deep and are drained into the sewer. A nine-way conduit is laid to the junction of Liverpool Street and George Street where the first feeder taps in: from there eight ways run, reducing to six. This conduit carries five feeder cables for the George Street lines and two for the North Sydney lines, the five George Street feeding points being Liverpool Street, the Markets, Hunter Street, Bridge Street, and Circular Quay. A single line is also laid up Engine Street. The feeder cables for underground work are Callender's make, 0·45 square inch sectional area, with an overall diameter of about $1\frac{3}{4}$ to $1\frac{7}{8}$ inches. For extension lines overhead feeders have been run of "weather-proof" cable, 5,000,000 circular mils area.



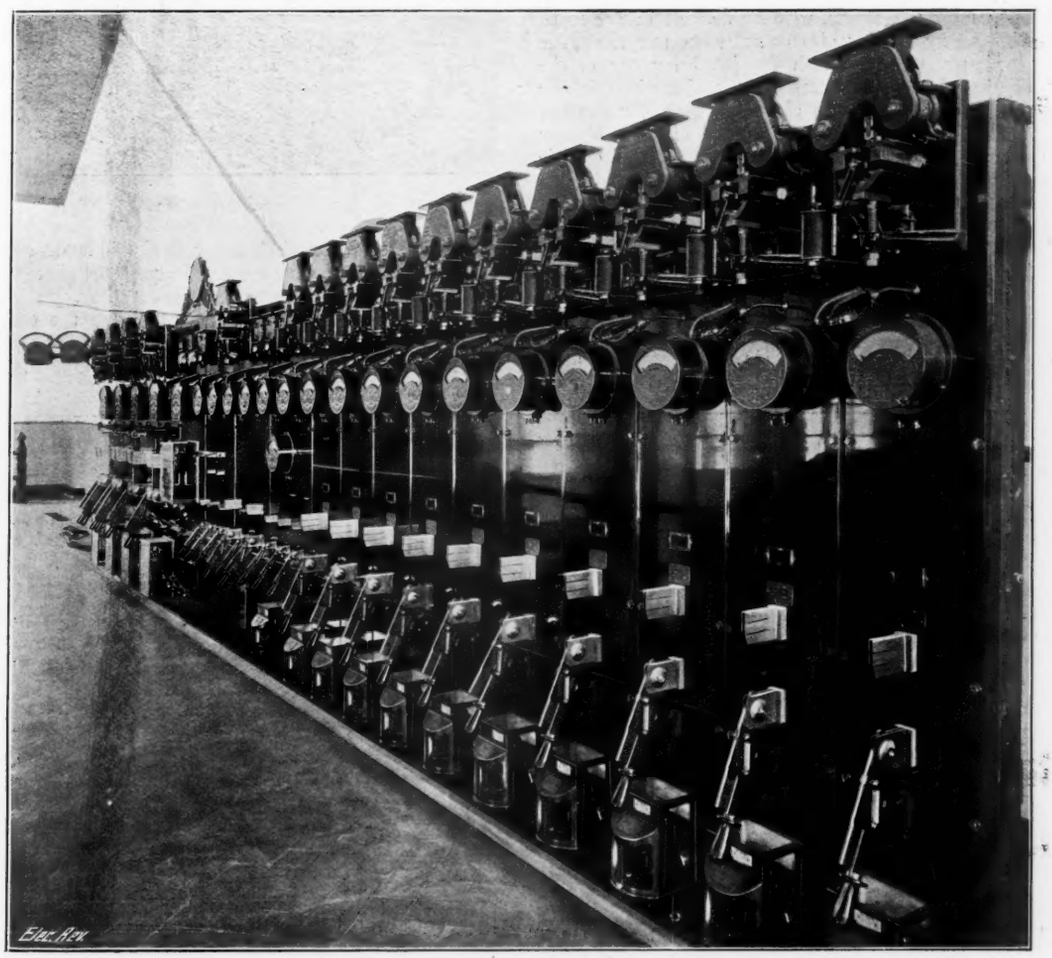
Car Barn at Ultimo.

The permanent way for the George Street and Harris Street line consists of 83-lb. grooved rails, Vignoles pattern, laid upon concrete with a wood-block road bed; all joints are bonded with Edison-Brown plastic bond. As a supplementary

return a copper cable of 0·45 square inch sectional area is laid between each track from Circular Quay to Redfern; each cable is connected to alternate rails on either side. These cables are laid against the inner rails of their respective tracks and cross-connected every 60 yards, the connection between the cable and inner rail being made with a special gun-metal clip bolt which has a lug bent round and sweated to the cable, and is provided with a shank to pass through the web of the rail. A copper strip $1\frac{1}{2}$ inches × $\frac{3}{16}$ inch, having one end bent round and sweated to the cable, joins it to the outer rail, the other end being amalgamated and clamped to the web of the rail by a gun-metal bolt. The bolt-heads and nuts—also amalgamated—are slightly undercut to form a receptacle for retaining a little plastic alloy. At the intersection of George Street and Liverpool Street nine cables, each of 0·45 square inch sectional area, are joined to the rails as supplementary returns, and return to the power house at Ultimo by the same route as the feeder cables, a distance of about 2,700 feet. There are no supplementary returns along Harris Street, but each track is cross-connected every 10 yards, and the tracks are connected together electrically every 100 yards. The whole of this cross-bonding is done with copper strips, $1\frac{1}{2}$ inches × $\frac{3}{16}$ inch, clamped to the web of the rail; at William Henry Street two cables, each of 0·45 square inch sectional area, connect the four rails to the power house. The supplementary cables are all coated with Stockholm tar, and the joints between rails and copper strips are served with a coating of P. and B. paint. The trolley wire is fig. 8 section having a sectional area of about 0·13 square inch, and is suspended by Billings & Spencer hangers.

Several types of car are used; and the car which has been found most suitable for the work is described as a "combination bogie or double dummy car," and the majority of the cars now being built are of this pattern, which may be seen in one of the photographs on page 749. It has an end to end platform length of 36 feet, with a width of 6 feet 3 inches, and is carried on two four-wheeled bogies; it weighs, when in full going order, about 10 tons. It is constructed to seat comfortably 48 passengers, the accommodation being provided in a central compartment entirely closed in, open sided seats being arranged at each end. These open sided seats can be reversed so that passengers may be better protected from wet weather. The under frame is of pitch pine, the car-framing of Tasmanian blackwood, with Kauri for ceilings, and panels of basswood; the trucks are of the well-known Brill & Peckham constructions. A trailer car is towed at busy times of the day. The traffic is already very heavy, over 150 cars being in use on George Street now, making a total of about 2,500 trips in and out during the day, and carrying over 100,000 passengers.

(To be continued.)



Switchboard at Ultimo Power Station.

CUTTING STRUCTURAL IRON BY MEANS OF THE ELECTRIC ARC.*

By J. R. Cravath.

It is now coming to be recognised—in Chicago at least—that under certain conditions the electric arc affords the cheapest and most convenient method of cutting structural

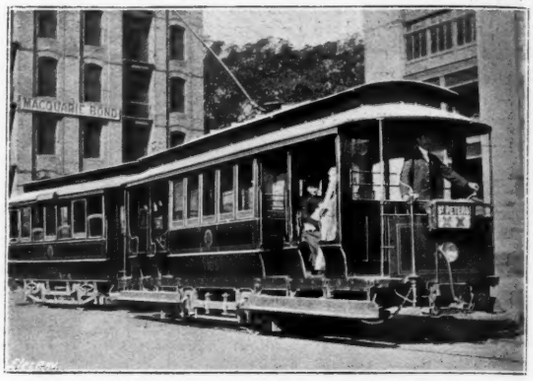
* *American Electrician.*

iron work or vault steel. In the reconstruction or alteration of modern office buildings, it sometimes happens that some of the steel girders forming the frame of the building must be cut to accommodate the necessary changes, and likewise the changes sometimes made in bank safety deposit vaults necessitate the cutting of the vault linings. Often the girders are in a place difficult to get at with saw or drill, and the cutting through of modern vault walls can only be done by annealing a spot, and then drilling it, and so on *ad nauseam* to the man doing the job and the people waiting for him to finish it. Under either of the conditions just mentioned, the electric arc demonstrates itself by far the quickest, most convenient, and economical method if current is available.

A year and a half ago six 18-inch I-beams in the New York Life Building, Chicago, were burned off in one-tenth of the time that would have been required to saw them, the saving in time required to finish the job being one of the main objects of the contractors for the alterations in the building. The expense was also less than for sawing. Recently six 14-inch I-beams were burned off in a similar way in the Rookery, at Chicago. Numerous jobs of electric burning to accommodate new vault doors, and get at broken locks, have also been done.

To do successful burning on structural steel a current of not less than 350 amperes should be used, though smaller currents will do the work, only more slowly. Vault steel is more fluid when melted, and does not clog as does structural steel. The carbon with which the arc is drawn is best about 1½ inches in diameter, and is, of course, connected to the negative side of the circuit. A heavy aluminium band bolted around the carbon has been found to be the best method of attaching the conductor cable; to this band a wooden handle is attached. For resistance to steady the arc a sufficient length of No. 18 German silver wire to absorb all but 70 or 80 volts, at the required rate of current flow, wound on a wood frame and put in a pail of running water, is a cheap and convenient method, and the one usually employed.

When connecting up to do such work, it must always be remembered that since the positive side is connected to the structure to be worked on, the insulation resistance to ground of the source of supply should be investigated, and any grounds on the negative side of the supply circuit must be removed. When drawing from an Edison three-wire central station supply (in which case the neutral is usually grounded intentionally or otherwise), the work should be done between the neutral and negative wires. To protect the eyes of the operator a sheet-iron box over the arc, heavily lined with asbestos, and having an insulated hole for the carbon, is generally used. Where it cannot be used, as in corners, a large sheet of thick asbestos board, with a hole through it for the carbon, is substituted. The operator should always wear double dark glasses, and if he observes the simple precaution of never looking directly at the arc, there is no danger whatever. If he does look at the arc for anything more than the briefest interval, he may be tolerably sure of a pair of very painful eyes the following night, even though he may feel no ill-effects immediately afterward. The cutting down by the arc is, of course, exceedingly rough and jagged, but for the purposes mentioned that is a small drawback compared with the saving in time and labour.

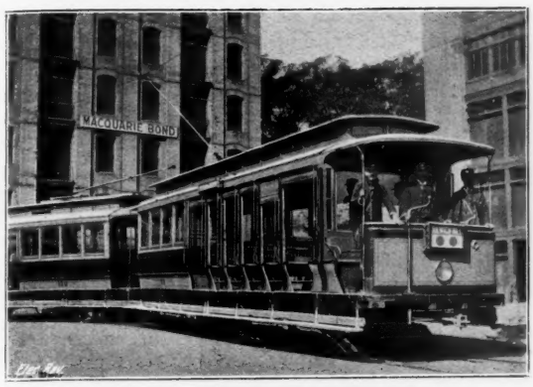


Sydney Tramways: Brisbane Type of Car.

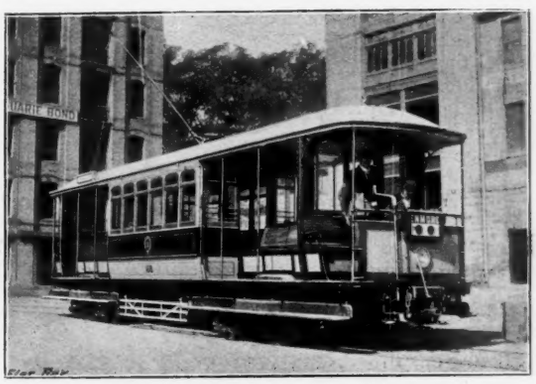
Sydney Tramways: Boiler House at Ultimo.

ELECTRICAL PLANT AT THE SNEYD COLLIERY.

The economy resulting from the application of electricity to mining operations is fast becoming realised by owners, managers, and engineers. A very few years have had a marked effect in strengthening the belief that true economy, measured by pounds, shillings, and pence, and convenience, is to be found by applying proper methods of electric transmission of power to the various operations in and about a mine where an unfailing supply of energy is required.

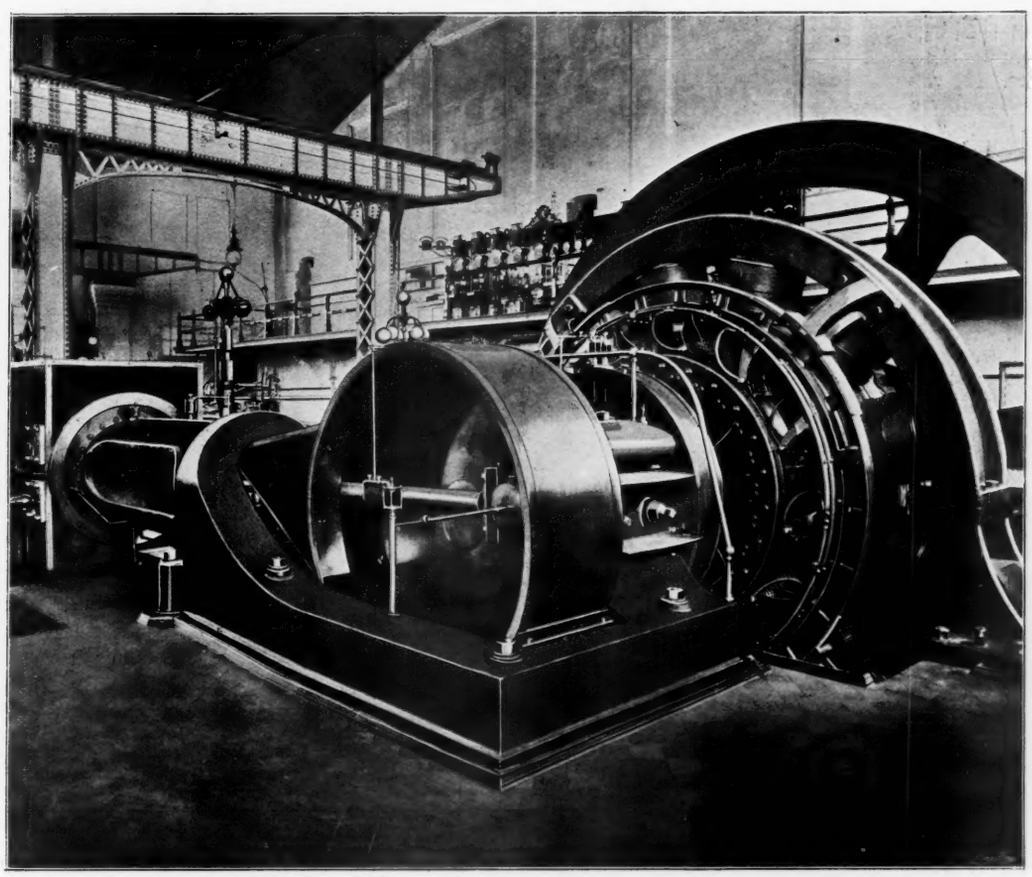


Sydney Tramways: The St. Louis Type of Car.



Sydney Tramways: Combination Bogie or Thow Car.

Various methods for utilising the electric current generated at the surface and transmitted to the workings, suggest themselves to the electrical engineer who is called upon to devise a safe, reliable, and durable system. Of these may be mentioned the direct current supplied to multipolar motors, enclosed in tight cast-iron cases, to protect the miner from the danger of explosion caused by the ignition of the inflammable gases from the sparks of the brushes. This serious drawback to the use of the direct current in places where gas is prevalent is wholly foreign to the induction motor, which has no brushes to give forth a spark, and which is a simpler and more mechanically perfect apparatus in every respect. This consideration alone, quite apart from the greater simplicity of alternating current generating apparatus, would be sufficient in cases of this kind to throw the balance in favour of the utilisation of an alternating current for driving the haulage systems and pumping machinery underground.



Sydney Tramways: Generator at Ultimo Power Station.

A recent example of the most modern electrical machinery applied to mining purposes is shown by the accompanying photographs, which represent several views of the Sneyd Colliery at Burslem, Staffordshire. The company secured the services of Dr. J. A. Fleming, who acted as consulting engineer, and the entire electrical plant was designed and constructed in accordance with his specifications.

The British Westinghouse Electric and Manufacturing Company received the contract for supplying and installing

the electrical and steam plant, and Messrs. Callenders supplied and installed the main cables connecting the generating plant to the various motors located at different points in the workings.

Fig. 1 is a view of the colliery showing the coal tipples and shaft headgear. The generating plant and switchboard are located in one of the buildings shown, of which fig. 2 is an interior view.

The generating unit consists of a Westinghouse 13½ inches × 12 inches Standard engine operating at 300 revolutions per minute and supplied with steam at 75 lbs. per square inch. A Westinghouse 50-KW. three-phase alternator is direct connected thereto, the two machines being mounted upon one cast-iron bedplate. A 2-H.P. 125-volt exciter is driven from the engine shaft by a link belt, and this machine supplies the exciting current for the alternator, with the exception of a small fraction of the total exciting current required, which is supplied from the commutator shown on the outside of the bearing of the alternator. This makes the unit self-regulating by allowing the necessary range of adjustment of the field magnet excitation to meet wide changes of load upon the alternator. This self-exciting current is derived through a small transformer located within the armature, through the primaries of which part of the armature current flows. The leads from the secondary of this transformer pass out through the shaft to the commutator, from which a continuous current at the required field voltage is derived, thus any change in the load on the machine is immediately met by a corresponding change in the magnetic field. The armature is of the well-known Westinghouse drum-wound type. The well insulated coils are secured in the slots by hard fibre wedges driven into grooves above the coils, and by this method all danger of displacement is avoided.

FIG. 1.—GENERAL VIEW, SHOWING POWER HOUSE.

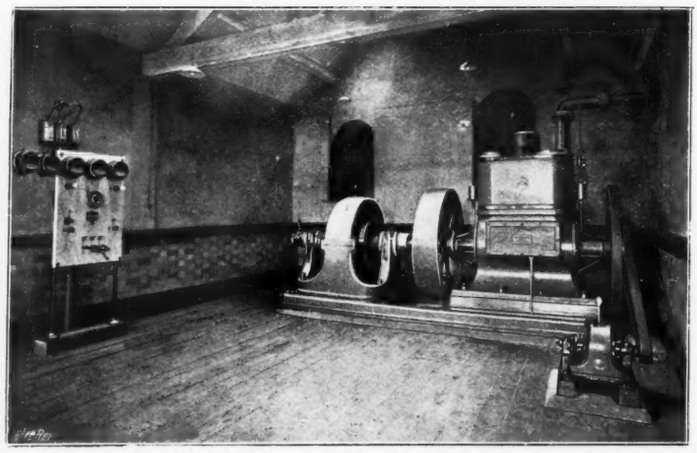


FIG. 2.—GENERATING PLANT AND SWITCHBOARD.

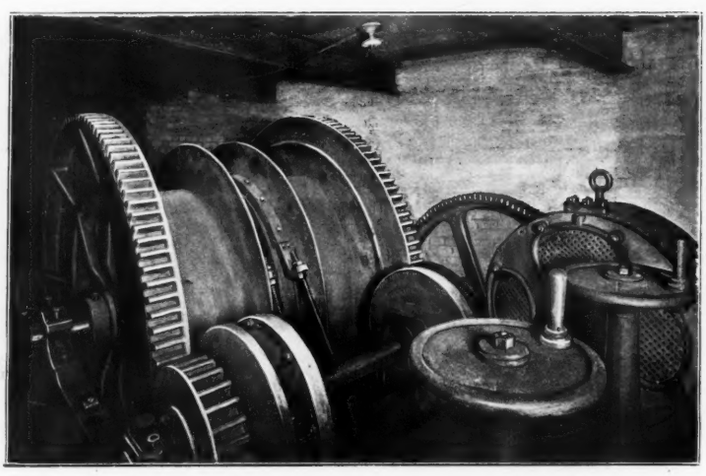


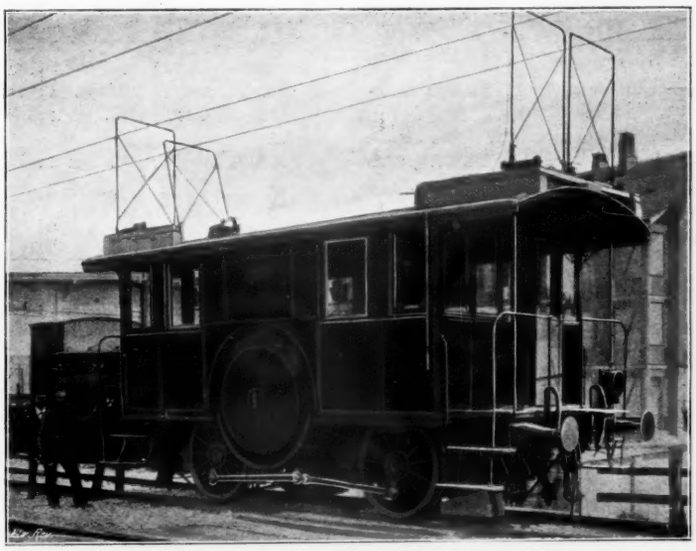
FIG. 3.—MAIN AND TAIL HAULING GEAR, OPERATED BY A 20-H.P. WESTINGHOUSE TYPE "C" ALTERNATE CURRENT MOTOR.

The current leaves the alternator at 440 volts, 25 cycles. The switchboard, from which the alternator, exciter, and circuits are controlled, consists of a single marble panel upon which are mounted three ammeters, one for each phase, a three-pole main switch, field plugs, and combination rheostat. The rheostat carries two concentric hand wheels shown on the board; the inner of the two governs the exciter shunt field current, and the outer the generator field. The swinging arm carries one A.C. and one D.C. voltmeter. The former can be used to read the potential difference between any two phases by means of the voltmeter plug, and the latter indicates the pressure of the exciting current. The main fuses are attached to the wall at the back of the board as shown. The switchboard is arranged to allow for the addition of a second generating set of the same capacity in the future.

The distance from the engine room to the shaft is 150 feet, and the depth of the shaft is 1,860 feet. The cable is laid in a wooden trench to the shaft, and is supported at intervals of 25 feet through the shaft by wooden cleats 3 feet long, which are secured to the walls by T headed bolts. The main cable is Callender's three-core type, the sectional area of the conductors being ·15 inch, ·15 inch, ·15 inch, insulated with bituminised fibre wormed circular, taped and sheathed

with vulcanized bitumen, taped, yarned, and armoured with lock coil steel wires, braided and compounded. This cable is proportioned for a current far exceeding the present load in order to provide for future extensions to the plant.

At the bottom of the shaft there is a junction box, from which the branch cables lead off to the two Westinghouse 20-H.P. induction motors. These cables have a sectional area of ·08 inch, ·08 inch, ·08 inch concentric, and are insulated with vulcanised bitumen, taped, yarned, and armoured with a single layer of No. 11 galvanized wire, yarned and compounded. These were supplied by W. T. Glover & Co. The total length of these branches is about 840 feet.



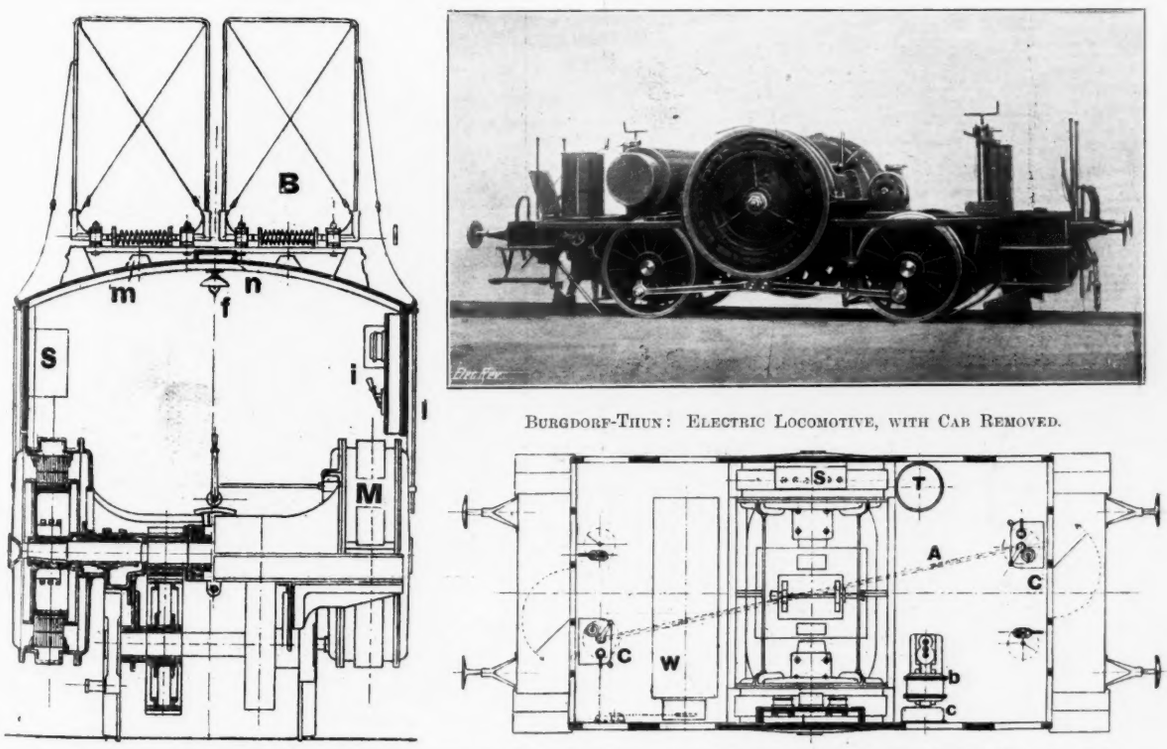
Burgdorf-Thun: Electric Locomotive.

Fig. 3 shows the main and tail hauling gear to which a Westinghouse induction motor is applied. The main and tail hauling gear operates a rope at a maximum speed of six miles an hour upon drums 4 feet diameter. The drums are connected to the motor through a system of gearing, and friction clutches are provided as shown. The motor is of the standard Westinghouse three-phase induction type, operating at 400 volts at 25 cycles at 720 r.p.m. It contains no rubbing surfaces except the two bearings, and is admirably adapted for such service, as the wearing parts are reduced to a minimum.

The endless hauling gear is also operated by a 20-H.P. Westinghouse induction motor. The gearing ratio is 48 to 1, and the motor runs at 720 r.p.m., which moves the rope at a speed of $2\frac{1}{2}$ miles per hour. Each motor is provided with a double-throw switch for reversing the direction of rotation. The hauling gears were supplied by the Uskside Engineering and Rivet Company. The pumping plant consists of a 30-H.P. Westinghouse three-phase 400-volt motor, which is geared to a 5 inches × 9 inches three-throw single-acting ram pump, which has a capacity of 62 gallons per minute against a vertical head of 780 feet. The pump is from the Uskside Engineering Company.

The simplicity of this installation cannot fail to strike those who appreciate the advantages of electric driving. When compared with other systems of transmission, such as compressed air, the advantages will appear in their true light. The comparative ease with which alterations and extensions can be made from time to time will be appreciated by engineers who have undertaken similar work on compressed air systems.

Burgdorf-Thun: Electric Locomotive, with Cab Removed.



Index to Parts:—M, 2 motors, 150 H.P., 750 volts; W, Common rheostat; C, Controller; B, Contact bows; T, Transformer, 18 KW., 750/100 volts; S, Fuse box A, Coupling rod between controllers; *b*, *c*, Air-compressor motor and automatic switch; *f*, Glow lamps; *i*, Switchboard; *l*, Device for hauling down the bows *m*, Hold-off catch; *n*, Cable duct.

Burgdorf-Thun: Sectional Plan and Elevation of Locomotive.

Friern Barnet.—The U.D.C. gives notice in the *London Gazette* of its intention to apply for a provisional order.

THE BURGDORF-THUN POLYPHASE ELECTRIC RAILWAY.

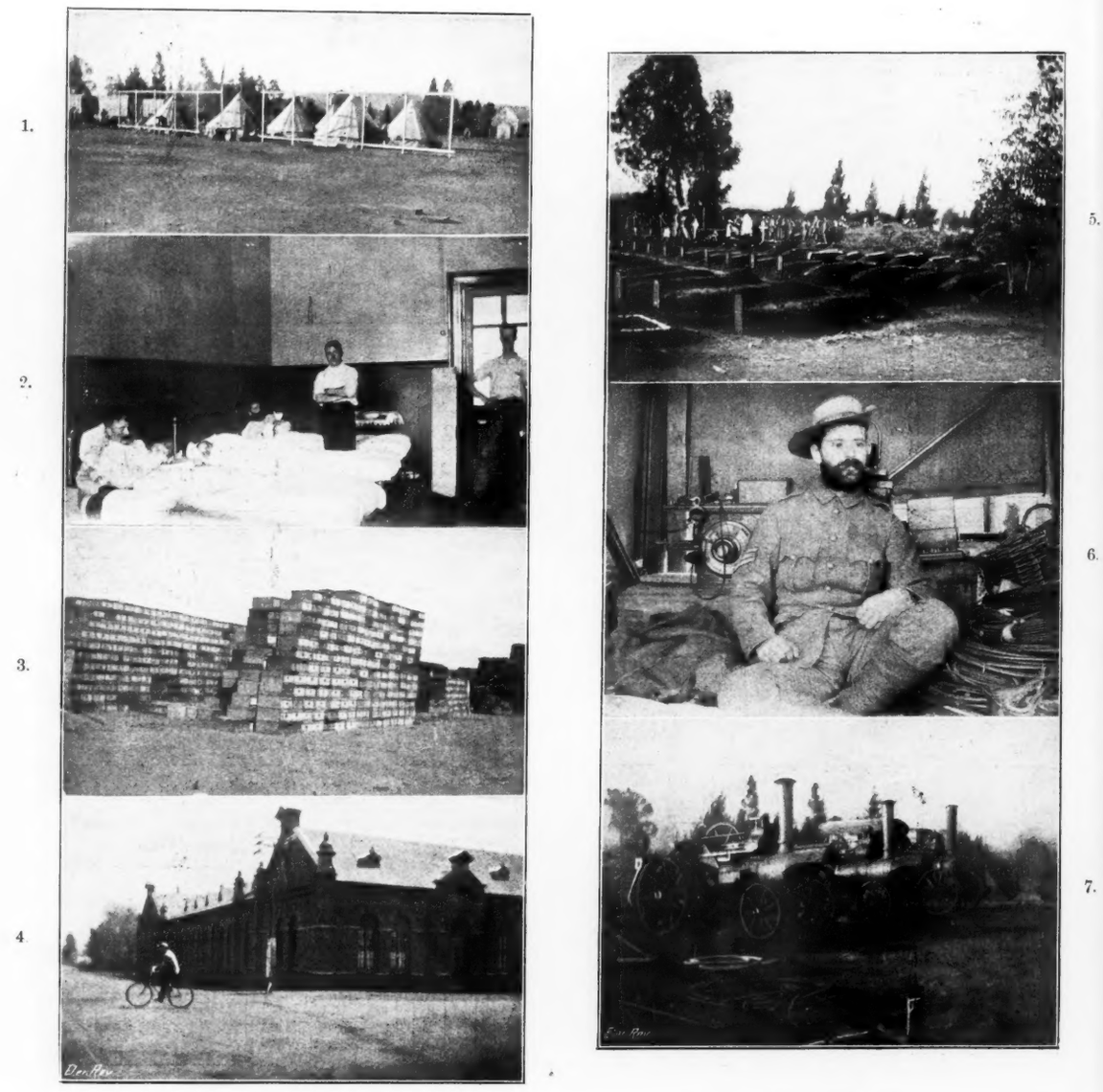
Translated from the Danish paper *Ingeniören* by J. Lehmann and W. Park. The original article was written by Will. Rung, E.E., of the firm of Brown, Boveri & Co.

(*Concluded from page* 697.)

The Electric Locomotive.—The locomotive has two axles, each carrying a maximum weight of 15 tons. The frame, bearings and brake arrangement are of similar design to those on the ordinary steam locomotive. Two electromotors, each of 150 H.P., act on either end of a common shaft, the bearings of which are supported on the frame midway between the two axles. The bearings are provided with self-lubricating rings. The motor shaft carries two spur wheels, either of which by means of a clutch may be driven by the shaft. They act upon two other wheels fixed to another shaft from which the power is transferred to the axles by rod and crank. When the one pair of spur-wheels is acting, the gearing ratio is 1/1·88, corresponding to a speed of 22 miles, and when the other pair is in action the ratio is 1/3·72, giving a speed of 11 miles per hour. The diameter of the driving wheels is 48·5 inches, and the number of revolutions of the motor 300 per minute.

The stator of the motor is bolted to the locomotive frame. By removing the exterior sheet cover, the rotor can be drawn out directly, and the stator itself can be removed without necessitating the removal of any other parts. The contact rings are easily accessible from the interior of the locomotive. The entire design of locomotive has been patented by Messrs. Brown, Boveri & Co., in connection with the "Schweizerische Locomotiv und Maschinenfabrik," Winterthur.

To regulate the speed a resistance common to both—mechanically connected—is provided, the contacts of which can be operated from either end of the locomotive by controllers of the type described above, which are connected to the resistance contacts by shafts and spur wheels. The locomotives are fitted with complete Westinghouse brakes, the compressor for which is driven, as in the case of the motor cars, by a small separate motor. The speed is observed by a recording tachometer. Besides the Westinghouse brake a common hand brake is provided. At either end of the locomotive there is a place for the driver, equipped with all apparatus necessary for regulating the speed and operating



1. E.E. camp at Pretoria, second position.
2. In hospital at Pretoria.
3. Stacks of rations, Zand River.
4. Exterior of Pretoria Electricity Works.
5. A military funeral.
6. Sergeant Ruse.
7. Park of engines in E.E. camp

Electrical Engineers R.E. Volunteers.

the brakes. The locomotive thus never needs to be turned.

Some dimensions are given below :—

Number of axles	= 2
Distance between wheels	= 10 feet 3½ inches
„ „ buffers	= 25 feet 3 inches
Number of motors	= 2
Total horse-power	= 300 H.P.
Voltage	= 750 volts
Number of revolutions per minute ...	= 300
Ratio of gearing	= 1/1·88 or 1/3·72
Diameter of driving wheels	= 48½ inches
Total weight	= 29·6 tons
Weight of the electrical equipment ...	= 10 tons
„ one motor	= 4 tons
Speed	= 11 or 22 miles

The Current Collectors.—These present several novel features, and have been patented by Messrs. Brown, Boveri and Co. They were designed to obviate the necessity of altering the position of the collector every time a car changed its direction of movement during shunting operations, and are made to automatically jerk themselves into the required position whenever the car reverses its motion. Moreover, the comparatively high speed of 22 miles an hour makes it important to have a special design, reducing, as far as possible, the heavy wear of the collector and conductors. For each wire two collectors are provided, one behind the other. This arrangement is necessary on account of the sidings, one of the leads being here interrupted for a short distance when crossing the other, and ensures that one collector will be in contact with the wire before the other has left it, so that the current is never broken.

The Rolling Stock.—This consists of :—

2 locomotives for goods trains, each tare	= 29·6 tons
6 motor cars with 66 seats „ ...	= 32 „
1 trailing car „ 24 „ „ ...	= 9·8 „
2 trailing cars „ 55 „ „ ...	= 14 „
2 „ „ „ 70 „ „ ...	= 13·2 „
2 „ „ „ 40 „ „ ...	= 9·65 „
3 combined passenger, post, and parcel cars, 20 seats each, tare	= 13·2 „

In addition, there are a number of goods cars and a steam locomotive. The trailing cars are fitted with electric light and heating. The current is taken from the motor car or locomotive through flexible cables with contact couplings.

Electric Lighting of the Stations.—All the stations with the exception of Thun are lighted by electricity. There are on the average 18 glow lamps per station, and also six arc lamps at Burgdorf. The pressure is 150 volts, and is obtained by transformers of 10 KW. capacity connected to the high pressure leads. They are contained in oil vessels and placed in the open air, supported by the two wooden poles, to which the reserve cut-outs are fixed as mentioned above. The railway was tested for the first time last summer with excellent results, and subsequent thorough tests and measurements have given extremely satisfactory results in every case. This will tend to show that the three-phase current, owing to its great simplicity and cheapness, will probably be adopted more and more for running electric railways.

ELECTRICAL ENGINEERS R.E. VOLUNTEERS.

THE present instalment of views of our friends at the front were, with one exception, taken at Pretoria. The first shows the Electrical Engineers' camp in its second position near the Railway Telegraph Stores. Next comes a corner of one of the hospital wards, but which of the many hospitals it was, we are, unfortunately, unable to say. No. 3 shows part of the huge stacks of rations which were accumulated at Zand River during the E.E.'s sojourn there. A view of the outside of the Electricity Works at Pretoria follows; these works were operated by the E.E. Volunteers. We regret that our views of the interior of this station turned out failures.

A sadder note is struck in the view which follows this—a military funeral in the cemetery at Pretoria. No apology, however, is needed for this reminder that not *all* our gallant friends passed safely through the perils to which they so willingly exposed themselves, not the least of which was that of disease.

Next we have a portrait of Sergeant Ruse, on his arrival at Pretoria from Bloemfontein; whether the gallant sergeant was bearded when he left these shores, we leave his friends to say. Lastly, we give a view of three traction engines, parked in the camp of the E.E. Volunteers.

CONTRACTS CLOSED.

(*Continued from page* 744.)

London.—The Bermondsey Vestry on Monday had under consideration the undernoted tenders for the supply (Contract No. 5) of steam, feed, exhaust and drain pipes, feed pumps, water storage tank, and sundry ironwork :—

Thos. Howden & Sons	£2,006 10 0
John Spencer, Limited (accepted)	2,672 10 0
Alton & Co.	3,023 0 0
Crompton & Co.	3,292 0 0
Babcock & Wilcox	3,483 0 0
Alley & Maclellan	4,500 0 0
Hopkins & Sons	5,673 0 0

The following tenders were also submitted for the supply and erection (Contract No. 6) of steam engines and dynamos, booster and balancer, and sundry electrical apparatus :—

	With Willans engine.	With Belliss engine.	With other types.
Thames Ironworks Co. ..	£4,334	..	£3,835 (Reavell)
Bergtheil & Young ..	..	..	3,988 „
„ „ ..	..	..	4,138 (Alley & Maclellan
Mather & Platt	4,840	£4,880	4,400 (Reavell)
			4,760 (Browett)
Crompton & Co.	4,906	4,727	4,429 (Reavell)
Scott & Mountain.. ..	..	..	4,495 (Scott & Mountain)
D. Bruce Peebles & Co..	4,924	4,768	4,764 (Browett)
J. D. Macdonald ..	..	..	4,788 (Macdonald)
Electric Construction Co.	4,942	4,730	....
Westinghouse Co. ..	5,409	5,109	5,000 (Scott & Mountain)
Siemens Bros. & C. ..	5,345	..	....

The consulting engineers (Messrs. Kincaid, Waller & Manville) in a report presented to the Electric Lighting Committee, stated after an examination of the tenders :—

The lowest tender, you will observe, is that of the Thames Ironworks Company, for their own electric generators, combined with Reavell engines, at £3,835. The same firm tender for their own generators combined with Willans engines, at £4,334. All the other tenders being considerably higher than this firm for Willans engines, you will probably not wish to consider the higher tenders, with the exception of that of Messrs. Bergtheil & Young, for dynamos combined with Reavell engines, at a price only a little higher than that of the Thames Ironworks Company. The Thames Ironworks Company are, as you are probably aware, a large firm situated almost in your neighbourhood. They have, of course, a very good reputation for all work they undertake to carry out. Their experience in the manufacture of electrical machinery has not been so great as that of some of the other firms tendering, but having regard to the good reputation of this firm, we consider that they can be relied upon to carry out any contract they enter into satisfactorily. Their tender with the Reavell engine is the lowest on the list of any. The Reavell engine is a comparatively new one, much of the same type as that made by Messrs. Willans & Robinson, which latter firm's engines have obtained a great reputation in this country, and have been turned out in very large numbers.

This type of engine is necessarily somewhat complicated, and as its efficiency depends so largely upon proper designing, and large experience of the results of the running of the engine after years of use, we cannot class the type of engine made by Messrs. Reavell with those made by Messrs. Willans and Robinson; and although there is a difference of £500 between the two prices, we think you will be better advised to pay the higher price and use the Willans engine. If you should, however, decide to use the Reavell engine, and compare the Thames Iron Works Company's price with that of Messrs. Bergtheil & Young, the latter firm, besides being somewhat higher than the Thames Ironworks Company, quote for dynamos made by the Bergmann Dynamo Works. We are not acquainted with this firm of dynamo manufacturers and believe that they must be either a Continental firm, or one in the United States of America, in either of which cases you will see that it will be impossible for you to enforce the stipulation as to the trade union rate of wages which no doubt makes some difference in the prices quoted by English makers, who must adhere to this condition set forth in the contract.

In regard to this question of the Trades Union rates of wages, we must point out to you that Messrs. Willans & Robinson state in their quotation to the Thames Iron Works Company that they take no exception to the clause if they may assume that the minimum rate of 6d. per hour paid to labourers applies only to the portion of the work done in London, and that their minimum rate for labourers in Rugby is £1 per week of 53 hours, which is 2s. per week higher than the usual rate paid for labourers in that district. Messrs. Reavell also object to paying a minimum rate of 6d. per hour for labourers for work done at Ipswich, but, as in the case of Messrs. Willans & Robinson, do not object to paying it for the part of the work done in London. In fact the objection of both these engine makers seems to us to be due to imperfect reading of the labour clause in the specification, which we take it is meant by you to refer to the union rate of wages paid in the locality in which the work is being done.

After due consideration of the report of the consulting engineers the Electric Lighting Committee recommended, and the vestry accepted, the tender of the Thames Ironworks Company, amounting to £4,334.

Glasgow.—Messrs. Lowdon Bros. & Co., of Dundee, have secured a contract for trolley standards for the Corporation. These trolley standards are the firm's own manufacture, fitted with patent double-wound springs and their own specially-designed insulator gear, and arranged so that the trolley pole may revolve any number of turns without injury to the cable. Mr. George Balfour, one of the partners of the firm, has also designed and patentedia special arrangement for unshipping the trolley pole without drawing out the cable from the motor. It is stated in the *Dundee Courier* as worthy of note, that this is the largest order for trolley standards that has ever been placed in one contract by any Corporation in Great Britain.

Cardiff.—The following is a list of the tenders received for the supply of electric tramway plant for the Corporation:—

Tabulated Tenders for Section No. 1 (Engines).

	Name.	Amount of tender.	Guaranteed efficiency per cent.
1.	Messrs. Ashton, Frost & Co.	£10,324 0 0	91
2.	„ R. W. Blackwell & Co.	18,305 6 0	92
3.	„ Cole, Marchant & Morley	13,408 0 0	90
4.	„ Victor Coates	12,400 0 0	88
5.	„ Caledon Shipbuilding Co.	15,137 0 0	88
6.	„ Dutilh Smith & Co.	12,900 0 0	90
7.	„ Dick, Kerr & Co.	—	—
8.	„ Ferranti & Co.	15,191 5 0	91
9.	„ Fowler & Co.	—	—
10.	„ Galloways, Ltd.	12,754 0 0	88
11.	„ Hick, Hargreaves & Co.	16,178 0 0	90
12.	„ Metcalf & Co.	11,305 0 0	90
13.	„ Musgrave & Co. (accepted)	14,508 0 0	91
14.	„ Nell & Co.	20,984 0 0	91
15.	„ Pollitt & Wigzell	15,906 0 0	90
16.	„ Stewart & Co.	14,786 0 0	88
17.	„ British Schuckert Co.	12,018 0 0	93
18.	„ Thames Ironworks Co.	—	—
19.	„ The Thomson-Houston Co.	13,303 10 0	92
20.	„ J. G. White & Co.	—	—
21.	„ Yates & Shaw	12,670 0 0	92
22.	„ Robey & Co.	13,682 0 0	90

Tabulated Tenders for Section No. 2 (Generators).

	Name.	Amount of tender.	Guaranteed efficiency per cent.
1.	Messrs. The Anchor Electric Co.	£6,400 0 0	93
2.	„ Ashton, Frost	6,799 0 0	93·5
3.	„ Bergtheil & Young	7,315 10 0	94
4.	„ The Brush Electrical Eng. Co.	8,208 0 0	94
5.	„ Cole, Marchant & Morley	—	—
6.	„ Crompton & Co.	9,015 0 0	92
7.	„ Dick, Kerr & Co.	7,600 0 0	94
8.	„ Dutilh Smith	6,820 0 0	94
9.	„ The Electrical Co.	—	—
10.	„ The Electric Construction Co.	8,810 0 0	93
11.	„ The General Electric Co.	—	—
12.	„ Galloway's, Ltd.	—	—
13.	„ Jackson Co.	9,914 0 0	—
14.	„ Johnson-Lundell Co.	—	—
15.	„ Lancashire Dynamo Co.	7,663 0 0	—
16.	„ Mather & Platt	8,715 0 0	93
17.	„ The British Schuckert Co.	7, 42 0 0	92
18.	„ Siemens Bros.	10,213 0 0	91
19.	„ Frank Suter & Co.	6,378 12 0	93
20.	„ Sunderland Forge Co.	12,458 0 0	90
21.	„ Thomson-Houston Co.	8,568 16 0	94
22.	„ Thame Ironworks Co.	8,874 0 0	93·5
23.	„ J. G. White & Co.	—	—
24.	„ Witting Bros.	6,300 0 0	91
25.	„ The Westinghouse Co. (accepted)	7,467 10 0	93
26.	„ Bruce Peebles & Co.	7,627 10 0	93

Section No. 3.—Boilers, &c.

Name.	Boilers.	Vicars stokers.	Bennis stokers.	Conveyor.	Elevator.	Bunkers.	Economisers.	Superheaters.	Water tank.	Pumps.
				B.	B.	B.				
Messrs. Arnott & Co.	—	—	—	— —	— —	— —	—	—	—	—
„ Victor Coates	3,700	730	650	— 170 —	— 160 —	— 800 —	530	440	500	390
„ Dick, Kerr & Co.	—	—	—	— —	— —	— —	—	—	—	—
„ Dutilh-Smith	—	—	—	— —	— —	— —	—	—	—	—
„ Evans	2,900	750	625	— 180	— 150	— 800	510	585	525	350
„ Galloways	3,040	720	628	168 + 288	138 +	866 804	530	620	560	370
„ Meldrum	Own make	Own make	705	— —	— —	— —	—	—	—	—
„ Musgrave *(accepted)*	2,952	685	595	159 10 + 280	131 10 +	917 762	512	558	698	395
„ Tinker	2,940	725	—	— —	— 138 —	— 965 —	550	590	720	380
„ J. G. White	—	—	—	— —	— —	— —	—	—	—	—
„ Yates & Thom	2,877	763	605	+ 305 + 288	+ +	958 800	530	566	581	378
„ Danks & Co.	2,767 10	—	628 14	— + 286	— +	— 7,981	530	450	495	371
„ Vicars (direct)	—	684 19		159 10 0	131 0 0	917 0 0				

Note.—Messrs. Tinker's tender reduced £265 if Bennis stokers are used.

In regard to Section 3, we should state that at last week's Council meeting, the tender of Messrs. Danks & Co., which had been originally accepted by the Committee, was withdrawn, and that of Messrs. Musgrave accepted instead. The boilers, economisers, superheaters, water-tank, and pumps, will be supplied by Musgraves, while Messrs. Vicars & Co. will supply direct, the stokers, conveyor, elevator, and bunkers. The figures marked with + indicate that they include both conveyor and elevator, whereas, others give separate amounts for these two items.

France.—The French Post and Telegraph Authorities in Paris have just placed contracts as follows :—500 kilometres of telephone cable (2 conductors) and 80 kilometres ditto., (14 conductors), M. Grammont, of Pont de Cheruy (Isère), at respectively 307,500 francs and 148,800 francs. Messrs. Aborlard & Co., of Paris, 160 kilometres of telephone cable (14 conductors) at 298,800 francs; La Société des Telephones, of Paris, 160 kilometres ditto. at 299,840 francs.

Glasgow.—The Telephone Committee have accepted the following tenders:—The International Electric Company, for post-office junction board, £292, and lightning and high voltage guards, £135 7s. 6d.; the Telegraph Manufacturing Company, inside wires, £179.

Glasgow.—The tender of Mr. James M'Millan, Port-Dundas Road, has been accepted for the girder work at Pinkston Electric Tramway Power Station, at £1,450. For the generating and sub-stations the following have been accepted:—The St. Helen's Cable Company, Limited, Warrington, connecting-up plant, £5,317; and Messrs. Mechan & Son, Scotstoun Iron Works, transformer connecting bars, £1,826.

London.—The Fire Brigade Committee of the London County Council received the following tenders for the electric lighting of the Redcross Street fire station:—

Barlow Bros. & Co., (accepted)	£270
The Electric Lighting Corporation	305
G. E. Taylor & Co.	320
F. A. Glover & Co.	321
Tamplin & Makovski	375
E. S. Berry, Harrison & Co.	440

The following tenders were also received for the electric lighting of the Shepherd's Bush fire brigade station:—

Barlow Bros. & Co., (accepted)	£260
The Electric Lighting Corporation	293
F. A. Glover & Co.	300
G. E. Taylor & Co.	310
Tamplin & Makovski	348
Berry, Harrison & Co.	414

Plumstead.—At the final meeting of the Plumstead Vestry on 26th ult., tenders were accepted for a scheme of electric lighting in conjunction with a dust destructor, subject to a loan being raised by the new municipal council. The tenders accepted were:—Meldrum Bros., destructor and setting for boilers, £7,885; Babcock & Wilcox, three water-tube boilers and fittings, £2,138; the same firm, electric lighting plant, £2,045; other tenders were accepted from the Wheeler Condensing Company, Alton & Co., William Boby, Worthington Pumping Company, British Westinghouse Electric Company, James White, Eclipse Brass and Copper Company, Carrick & Ritchie, Callender's Cable Company, British Electric Motor Company, and Johnson & Phillips. A suggestion that the acceptance of the tenders should be left for the new council to deal with was not adopted.

Sheffield.—The Electric Construction Company has secured the contract for two two-phase alternators and engines at £13,840, and for the alteration of the existing single-phase alternators at schedule prices.

FORTHCOMING EVENTS.

Friday, November 9th.—At 5 p.m. Physical Society. (1) "Electromotive Force and Osmotic Pressure," by Dr. R. A. Lehfeldt; (2) "On Astigmatic Lenses," by R. J. Sowter. (3) (*a*) "On a Phase-turning Apparatus for use with Electrostatic Voltmeters."(*b*) "On a Method of Measuring Power in Alternate-Current Circuits." (*c*) "Note on obtaining Alternating Currents and Voltages in the same Phase for fictitious Loads," by A. Campbell, B.A. (4) "On the Refraction of Sound by Wind," Dr. E. H. Barton.

Wednesday, November 14th.—At 8 p.m.—Institution of Electrical Engineers (Glasgow Local Section). Meeting at Institution of Engineers and Shipbuilders, 207, Bath Street, Glasgow; paper on "Electrical Supply" by W. A. Chamen.

At 7.30 p.m.—Institution of Electrical Engineers (Students' meeting) at 28, Victoria Street. Paper on "Overhead Line Material," by A. J. Ll. Hurst.

however, is needed for this reminder that not *all* our gallant friends passed safely through the perils to which they so

trolley standards that has ever been placed in one contract by any Corporation in Great Britain.

Friday, November 16th.—At 7.30 p.m. North-East Coast Institution of Engineers and Shipbuilders, second general meeting at Sunderland, paper on "Liquid Fuel," by E. L. Orde.

At 8 p.m.—Institution of Mechanical Engineers. Ordinary meeting at Storey's Gate, S.W., paper on the "Capacity of Railway Wagons, as affecting Cost of Transport," by J. D. Twinberrow.

At 8 p.m.—Electro-Harmonic Society. Concert at the St. James's Hall Restaurant, Regent Street.

NOTES.

To Electrical Contractors.—A number of letters have been appearing in our columns during the past few weeks, in which the writers have expressed the view that there is a necessity for electrical contractors connected with their particular branches of the industry to band themselves together in order to have organised protection against certain undesirable influences which are at work inimical to their interests. The suggestions made so far favour the formation of an Electrical Contractors' Protection Association. We shall be glad if all among our readers who are interested in the matter will communicate their views to us, not necessarily for publication, but just to indicate to us the grievances under which they labour, and any steps they would advocate for remedying them assuming that such an Association were considered desirable.

Electro-Harmonic Society.—The next concert of this Society is to be held on Friday next, November 16th, at the St. James's Hall Restaurant. In addition to it being a ladies' evening, there are other attractions, which, we have no doubt, will lead to a very successful gathering. Major R. E. Crompton, who recently returned from South Africa, will preside, and we note that Nelson will render a couple of glassophone solos, while Roberts will entertain with humorous recitations. Lord Roberts's dispatches have frequently given evidence of dry humour. The Westminster Glee Singers will be there, and Miss Elsie Mackenzie and Mr. Izard are to take part in the programme.

Royal Society.—Sir William Huggins, D.C.L., LL.D., has been recommended for election as president of the Society at the anniversary meeting to be held on November 30th.

The Royal Society's medals, which will be presented at the anniversary meeting, are the following:—The Copley Medal to Prof. Marcellin Berthelot, For.Mem.R.S., for his brilliant services to chemical science; the Rumford Medal to Prof. Antoine Henri Becquerel, for his discoveries in radiation proceeding from uranium; a Royal medal to Major Percy Alexander MacMahon, F.R.S., for the number and range of his contributions to mathematical science.

Trials of Electrical Vehicles.—In connection with the Automobile Club's trial of electrical vehicles on Tuesday, the route was severe, and the roads were very heavy in mud. The "Powerful," entered by the British and Foreign Electrical Vehicles Company, carrying two passengers, covered 59 miles. The same company's "Columbia Stanhope" traversed 7½ miles; their delivery van chose an easier route, going 7 miles, but failed to carry her three passengers all the way. Mr. Hart's "Toujours Contente" travelled 34 miles with two passengers, and the National Motor Carriage Syndicate "Joel" car carried two persons 37 miles. The Electric Motive Power Company's two cars ran 17¼ and 35 miles respectively, each carrying two passengers. The Canadian Electric Motor Company's "Still" carriage carried four persons 18 miles, and the Electrical Undertakings Car conveyed two persons 35 miles. On Wednesday the hill-climbing trials between Chislehurst and Knockholt took place.

Lecture.—Dr. Oliver Lodge lectured at the Westbourne Park Institute last week on "Modern Views of Matter."

Personal.—Mr. J. Ferguson Bell, the late manager of the Stafford Corporation gas and electricity works, was last week presented with a silver tea and coffee service, a handsome salver, and a silver tray, by his friends and the staff and workmen. Mr. Bell is now manager to the Derby Gas Company.

We observe from the *Review of the River Plate* that Mr. A. H. Preece has arrived out there to report on the various stations of the River Plate Electric Light and Traction Company, Limited, and to advise what should be done to put the company on a sound footing again.

The Newport Board of Guardians have appointed Mr. A. J. Evans electrical clerk of the works to superintend the electric light installation at the workhouse.

At Glasgow last week Mr. Andrew S. Dunn, the retiring electrical engineer and telegraph superintendent of the Caledonian Railway, was presented by the staff of the department with a valuable gold lever watch, bearing a suitable inscription recording the regard and esteem in which he has been held by the staff during his long connection with the department. Mrs. Dunn was presented with a silver afternoon tea service, a diamond and sapphire ring, and a pearl spray brooch.

Mr. G. Swift, of the Electric Construction Company, Wolverhampton, has been appointed "shift engineer" at the Blackburn electricity works, in the place of Mr. J. W. A. Benner, who has been appointed assistant engineer at the Accrington Corporation electricity works.

Mr. Gilbert C. Vyle has accepted the appointment of assistant to Mr. A. Brooker at the General Electric Company's factory, Manchester; on terminating his services at the National Telephone Company's factory, Nottingham, on Monday last, the staff and employés met together and presented him with a handsome gold albert and seal and silver match-box as a slight token of their respect and esteem. Mr. G. C. Vyle is down in the prospectus of the current session of the Nottingham University College, under Prof. Hinton, M.A., as head of the telegraphy and telephony classes. This office he has resigned.

Mr. J. W. Beauchamp has been appointed works manager at the Sheffield electric light department factory, Suffolk Road, at a salary of £200 per annum.

Mr. S. E. Britton, electrical engineer to the Barking Town U.D.C., has been appointed electrical engineer to the Motherwell Burgh Commissioners at £250 per annum. There were 48 applicants.

Appointments Vacant.—The Portsmouth Corporation wants a telephone manager and engineer at £200 a year. An electrical mains superintendent at £150 per annum is wanted for Cardiff. An assistant engineer at £110 per annum is required for the Bolton electricity department. A junior assistant is wanted for the Belfast electricity mains department. A first-class jointer is wanted as mains foreman at Whitehaven. A chief assistant engineer is wanted for the Cardiff electric tramways at £225 per annum. The Wigan Corporation is advertising for four engineers-in-charge at £104 per annum, a works foreman, engine drivers, stokers, and meter inspector. A resident electrical engineer at £200 per annum is wanted for the Barking electricity works. See "Official Notices" to-day.

Royal Institution.—The annual course of Christmas lectures, specially adapted to young people, at the Royal Institution, will be delivered by Sir Robert S. Ball, F.R.S., Lowndean Professor of Astronomy in the University of Cambridge, whose subject is "Great Chapters in the Book of Nature." The first lecture will take place on Thursday, December 27th, at 3 o'clock, and the remaining lectures will be delivered on December 29th, 1900, and on January 1st, 3rd, 5th, and 8th, 1901.

Institution of Civil Engineers.—The opening meeting of the eighty-second session of this Institution was held on Tuesday evening at Great George Street, Westminster, Sir Douglas Fox, the retiring President, in the chair. The chairman introduced his successor, Mr. James Mansergh, who assumed the chair and delivered his presidential address.

Glasgow.—The Telephone Committee have accepted the following tenders:—The International Electric Company, for post-office junction board, £292, and lightning and high voltage guards,

At 7.30 p.m.—Institution of Electrical Engineers (Students' meeting) at 28, Victoria Street. Paper on "Overhead Line Material," by A. J. Ll. Hurst.

American Amenities.—Sandwiched between an article on "Trolley Trips" and another on the "Growth of Grass in Streets," in a recent issue of a New York paper called the *Electrical Review*, is a dissertation on "Technical Journals," which for its calm self-satisfaction and elevation of spirit is in the highest degree worthy of its place of origin. Thus says our contemporary:—"It may be said truthfully that in no field of industrial activity are the technical journals so representative, so instructive, and so important to those engaged in the actual work, as in that of electricity and its applications; and one may take a little justifiable pride in the fact that of all technical journals in the electrical field those published in the United States are the best. Our British cousins are a very close second, however, and considering the state of development of the electrical arts in their country, are certainly more than creditable to their editors and publishers."

We do not propose to enter into an elaborate comparison of the merits of British and American technical journals; we prefer to let our work speak for itself. We are not so overwhelmed with admiration for American journals as is our American namesake, but we can, at least, credit the latter with knowing a good thing when it sees it, for on p. 397 of the same issue in which the British technical press is patronised we find an article on "Molecular Changes produced in Matter by Electric Waves." This article was written specially for us, and was published in our issue of September 21st; no intimation of its origin, however, appears in our contemporary. We regret that we cannot return the compliment of the *Electrical Review*, New York—we cannot say that the methods upon which it is produced are by any means creditable to its editors. Unlike our modest namesake, we have never claimed the pre-eminent position in the world's press; but in the matter of honourable dealings we yield to none.

The Coal-Eating Water-Tube Boiler.—The following appeared in the *Pall Mall Gazette* on Tuesday:—"In the course of a debate last session on the demerits of the water-tube boiler as a steam generator for our larger warships, Mr. Charles Wilson, M.P., the head of the Wilson line of steamships, mentioned that he was sending his steamer, *Martello*, on a 7,000-mile trial trip, in order to test the comparative merits of the water-tube boiler and the old cylindrical boilers which had been taken out of the same ship. Mr. Wilson claimed at the outset that a saving in weight had been effected, as between the cylindrical and the water-tube boilers, of 100 tons. The *Martello's* trip has been completed, and we learn that the results have been most unfavourable to the water-tube boiler (which is *not* the Belleville). The coal consumption of the steamer, to produce the same results as the old cylindrical boilers, was higher by 16 tons a day, so that she burned on the trip 448 tons more coal than she had burned on a similar trip with the cylindrical boilers. This represents so much more coal to carry on the voyage, and this 448 tons of extra coal completely swamps the economy of 100 tons in boiler weight saved. It is only fair to say that Mr. Wilson has a perfectly open mind on the question; this test is an evidence of it." We need hardly remind our readers that we have from time to time laid stress upon this point, which is now so forcibly demonstrated by Mr. Wilson's tests.

Night Signalling.—Signalling at night time is carried out in the Navy almost entirely by the Morse code. For ordinary signals a hand lamp burning oil is used and the flashes made by mechanical means, a shutter which obscures the flame being alternately lifted and released at varying intervals, making long and short flashes. As compared with the semaphore which is used by day, the Morse is tedious and lengthy, but when used in place of flags, where a single hoist of three or four flags conveys a complete message, there can be no question about the restriction that is put upon signalling at night time. An electric lamp at the masthead is often used in place of the hand lamp, the long and short flashes being produced by an ordinary Morse key in the lamp circuit, but the flashes are not sharp owing to the carbon filament taking an appreciable time to cool. This still further lengthens the time taken to transmit a message, and in cases of emergency this time is of considerable importance.

A system of coloured lamps was first introduced, I believe, by the Americans, and subsequently by the French and Germans, and experiments are now being tried in our own Navy. The lanterns consist each of three lamps placed vertically, and shaded respectively with red, clear and green glass. These lanterns are hoisted at dusk, and are supposed to remain up all night ready for instant use. Suppose there are three in a vertical line, it will be seen that an enormous number of combinations can be made according to the particular lamp that is glowing in each lantern. Thus they may each be showing red, or one may be showing a different colour to the other two; or, again, all may be different. By this means instant distinctive messages can be sent according to a code. There is a very great disadvantage, however, in the complicated circuit, for, of course, each lamp in the lantern must have a separate circuit, and this means a mass of leads at the masthead, which get foul of the rigging, and are a nuisance to stow away during the daytime. There seems to be an opening for a switch that could be put into a single circuit, and made to control each individual branch from it independently of the rest, and the idea is by no means impossible of realisation.

The Pacific Cable Scheme.—Some remarks made on Wednesday by Sir J. Wolfe Barry, at the meeting of the Eastern Extension Telegraph Company, lend authority to the statement that the Telegraph Construction and Maintenance Company are to receive the main contract for the Pacific cable. They will be found in our "City Notes" this week.

Late Letter.—We have received, too late for insertion in this issue, a letter from Mr. H. Boot in reply to a *critique* which appeared in our columns last week.

NEW COMPANIES REGISTERED.

Richardsons, Westgarth & Co., Limited (67,599).—This company was registered on October 29th, with a capital of £700,000 in £1 shares, to acquire the undertakings of Thomas Richardson & Sons, Limited, Sir Christopher Furness, Westgarth and Co., Limited, and William Allan & Co., Limited, and to carry on the business of marine, electrical and mechanical engineers, boiler makers, founders, smiths, &c. The first subscribers (each with one share) are:—Christopher Furness, Kt., West Hartlepool; T. Richardson, Kt., Hartlepool; D. B. Morison, Hartlepool Engine Works, Hartlepool; Tom Westgarth, Middlesbrough, engineer; G. Westgarth, Coatham Redcar, accountant; A. Harrison, Scotia Engine Works, Sunderland, engineer; and W. B. Peat, 3, Lothbury, E.C., chartered accountant. The number of directors is not to be less than three nor more than nine; the first are Sir Christopher Furness, M.P. (chairman), Sir Thomas Richardson (vice-chairman), W. J. Richardson, William Allan, M.P., Stephen W. Furness, Tom Westgarth and D. B. Morison; qualification, £1,000; remuneration, £2,500 per annum, divisible. Registered office, Hartlepool Engine Works, Hartlepool, Durham.

Railway Construction and General Development Company (Tasmania), Limited (67,614).—This company was registered on October 30th, with a capital of £100,000 in £1 shares, to acquire the business of the Great Western of Tasmania Railway and Electric Power Company, Limited, and to carry on the business of railway and tramway proprietors, electricians, engineers, contractors, &c. The first subscribers (each with one share) are:—M. E. Williams, Winchester House, E.C., solicitor; J. F. Seacombe, 72, Lucas Avenue, Upton Park, Essex, accountant; C. F. Gillard, 80, Winchester House, E.C., clerk; F. Grant, 140, Clyde Road, South Tottenham, clerk; E. R. Maunder, 80, Winchester House, E.C., clerk; R. E. Coombe, 7, Victoria Villas, Sirdar Road, Wood Green, N., clerk; D. S. Whitelaw, 357, Winchester House, E.C., secretary; and H. W. Rydon, Winchester House, E.C., solicitor. The number of directors is not to be less than two nor more than seven; the first are to be appointed by the subscribers; qualification, £100; remuneration, £150 each per annum and £50 extra for the chairman.

bourne Park Institute last week on "Modern Views of Matter."

who assumed the chair and delivered his presidential address.

Columbia Motor Car Company, Limited (67,615).—This company was registered on October 30th, with a capital of £1,000 in £1 shares, to manufacture, sell, let on hire and deal in electric motors, cycles, bicycles, tricycles, velocipedes and vehicles, and to carry on the business of electricians, engineers, smiths, wire drawers, tube makers, saddlers, rubber manufacturers, oil merchants, platers, &c. The first subscribers (each with one share) are:—H. H. Fox, 2, Brick Court, Middle Temple, London, solicitor; J. Woodall, 56, Oakley Road, Canonbury, N., clerk; E. Wallace, 56, Mornington Road, N.W., law stationer; L. Rendell, 5, Hanover Mansions, Maddox Street, W., solicitor; J. B. Taylor, 40, Patshull Road, N.W., clerk; G. F. Seagrave, 69, Falkland Road, Harringay, N., accountant: and J. P. Eldridge, 16, Marlborough Road, Bowes Park, N., shorthand writer. Registered without articles of association.

Electrical Trades Supply, Limited (67,616).—This company was registered on October 30th, with a capital of £5,000 in £1 shares, to carry on in Birmingham or elsewhere the business of electrical, gas, water and mechanical appliance manufacturers, motor car, cycle, vehicle, dynamo, motor, telephone, bell, electrolier, accumulator, lamp and fittings manufacturers, india-rubber merchants, chemical manufacturers, &c. The first subscribers (each with one share) are:—R. A. Marples, 68, Westminster Road, Birmingham, electrical engineer; J. Lockett, County Chambers, Corporation Street, Birmingham, incorporated accountant; A. Hirons, 34, George Street, Balsall Heath, Birmingham, telegraphist; T. Assinder, 39, Larches Street, Sparkbrook, Birmingham, cashier; A. Burt, 98, Nechells Park Road, Birmingham, accountant's clerk; R. A. Hemming, 41, St. Paul's Road, Birmingham, accountant's clerk; T. J. Kennedy, 16, Edgbaston Road, Moseley, Birmingham, manager. Registered without articles of association.

Electric Vehicle Company of Great Britain, Limited (67,618).—This company was registered on October 30th, with a capital of £1,000 in £1 shares, to manufacture, sell, let on hire, or otherwise deal with electric motors, cycles, and vehicles of all kinds, and to carry on the business of engineers, electricians, smiths, tube makers, wire drawers, platers, &c. The first subscribers (each with one share) are:—H. H. Fox, 2, Brick Court, Middle Temple, London, solicitor; J. Woodall, 56, Oakley Road, Canonbury, N., clerk; E. Wallace, 56, Mornington Road, N.W., law stationer; L. Rendell, 5, Hanover Mansions, Maddox Street, W., solicitor; J. B. Taylor, 40, Patshull Road, N.W., clerk; G. F. Seagrave, 69, Falkland Road, Harringay, N., accountant; and J. P. Eldridge, 16, Marlborough Road, Bowes Park, N., shorthand writer. Registered without articles of association.

Kettle River Power Company, Limited (67,627).—This company was registered on October 31st, with a capital of £320,000 in £1 shares, to acquire all or part of the property, rights, shares, stock and securities of the Cascade Water-power and Light Company, Limited, incorporated by an Act of the Legislature of British Columbia in 1897, to adopt an agreement with the London and British Columbia Goldfields, Limited, and to carry on in America and elsewhere the business of suppliers of electric light, heat and power manufacturers and constructors of telephones, telegraphs, cables, wires, lines, meters, works and conveniences, electrical and mechanical engineers, electricians, &c. The first subscribers (each with one share) are:—G. Kerr, 14, Estelle Road, Hampstead, N.W., accountant; A. R. Pearson, 64, Hurstbourne Road, Forest Hill, S.E., clerk; M. B. Winnall, Chipstead, Broughton Road, Thornton Heath, registrar; J. E. Oden, 34, Stanton Square, Lower Sydenham, clerk; A. P. Tosh, 27, Hillfield Avenue, Hornsey, N., clerk; W. Smith, 324, Stanstead Road, Catford, secretary; and E. Hart, 30, Moorgate Street, E.C., chartered accountant. The number of directors is not to be less than three nor more than seven. The subscribers are to appoint the first; qualification, £250; remuneration as fixed by the company. Registered office, 3, Laurence Pountney Lane, E.C.

British and Foreign Electrical Vehicle Company, Limited (67,650).—This company was registered on November 2nd, with a capital of £150,000 in £1 shares, to acquire the business of the Leecoll Electric Battery Company, Limited (incorporated in 1899), to adopt an agreement with Emily H. Maquay (administratrix of the late S. W. Maquay) and P. E. Vanderpump, and an agreement with S. A. Cobbett, on behalf of the Leecoll Electric Battery Company, Limited, and to carry on the business of electricians, mechanical and electrical engineers, motor car and launch builders, &c. The first subscribers (each with one share) are:—E. W. Hart, Luton, Beds., engineer; B. H. Hart, Luton, Beds., bleacher; W. S. Jeal, 134, High Street, Sydenham, S.E., engineer; A. Drury, 108, Shakespeare Road, Acton, W., clerk; S. A. Beckett, 94, Cambridge Road, Seven Kings, Ilford, clerk; S. A. Cobbett, 14, Devonshire Square, E.C., secretary; and S. J. Warner, 164, Lambeth Terrace, Lambeth Road, S.E., engineer. The number of directors is not to be less than four nor more than seven; the first are to be appointed by the subscribers; qualification, £500; remuneration, £600 per annum, and a share in the profits, divisible. Registered office, 14, Devonshire Square, E.C.

J. Wakefield & Sons, Limited (67,634).—This company was registered on November 1st, with a capital of £21,000 in £1 shares, to acquire the business of lamp manufacturers and brass founders carried on at Birmingham under the style or firm of "J. Wakefield & Sons," and to carry on the business of manufacturers of and dealers in gas and electric lamps, fittings and accessories, manufacturers of articles made wholly or partly of brass, copper, steel, iron or other metals, or of porcelain, earthenware, or glass, brass, iron, and steel founders, casters, stampers, piercers, platers, engineers, &c. The first subscribers (each with one share) are:—Harry Wakefield, 38, Theodore Street, Birmingham, manufacturer; Walter Wakefield, 33, Westminster Road, Handsworth, Birmingham, surgeon; Miss Emily S. L. Wakefield, 33, Westminster Road, Handsworth, Birmingham; John B. Wakefield, 38, Theodore Street, Birmingham, manufacturer; Ralph W. Wakefield, 38, Theodore Street, Birmingham, manufacturer; Mrs. Elizabeth A. Wakefield, 51, Grosvenor Road, Handsworth, Birmingham; and Mrs. Maggie Wakefield, Davos, Chester Road, Erdington. The number of directors is not to be less than two nor more than five; the first are Harry Wakefield (chairman), and John B. Wakefield; qualification, 500 shares; remuneration as fixed by the company.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Chloride Electrical Storage Syndicate, Limited (35,389).—This company's annual return was filed on October 16th, when 80,000 "A," 30,000 "B," 100,000 "C," and 12,500 founders' shares were taken up out of a nominal capital of £262,500 in 80,000 "A," 30,000 "B," 140,000 "C," and 12,500 founders' shares of £1 each. £1 per share has been called up and paid on 65,000 "A," and £157,500 is considered as paid on the remainder.

Halifax and Bermudas Cable Company, Limited (28,972).—This company's annual return was filed on October 11th, when the entire capital of £50,000, in £10 shares, had been taken up and paid for in full.

Johnson-Lundell Electric Traction Company, Limited (65,699).—The company's annual return was filed on October 26th, when 35,061 partly-paid, 1,131 fully-paid, and 15,950 deferred (fully-paid) shares were taken up out of a nominal capital of £300,000 in 40,000 partly-paid, 4,000 fully-paid, and 16,000 deferred (fully-paid) shares of £5 each; £3 per share has been called up on 35,061 shares, resulting in the receipt of £102,380 10s.; £2,802 10s. remains in arrears; £85,405 is considered as paid on 17,081 shares.

SUPPLY STATION ACCOUNTS.

Leeds Corporation Electricity Accounts.

The supply of electrical energy at Leeds was in the hands of the company from the start, in May, 1893, to the end of August, 1898, when the business was handed over to the Corporation. As a result, the accounts issued deal with six months from October, 1898, to March, 1899, before a full financial year is reached. The comparison between figures for a winter period of six months and the following 12 months is worth very little, and, although we have adopted our usual form of analysis, the rises and falls are to be regarded as indicating as much the difference between a winter's season and a winter with summer season as anything else.

The extensions are proceeding rapidly.

General Statement.

	1898.	1899.	Increase.
Total capital expenditure ...	£236,733*	£307,522	£75,006†
Number of units sold	1,001,540	2,005,840	2,760
Maximum load in KW.	2,214	2,216	2
Gross revenue	£18,281	£36,221	... ‡
Gross expenditure	£4,178	£9,930	... ‡
Gross profit	£14,103	£26,291	... ‡
Number of lamps connected ...	101,223	106,263	5,040
Average price per unit sold ...	4·12d.	4·07d.	−·05d.

* Capital depreciated, £4,217, for old material sold. Net capital = £232,516.
† Net capital. ‡ No useful figure.

The revenue reached the substantial sum of £36,000 with an average of just 4¼d. per unit from all sources. There is little change in the figure. We suppose the Corporation will be able to reduce the charge before very long.

Revenue Statement.

	1898. Gross.	1898. Per unit	1899. Gross.	1899. Per unit.	Increase.
Sale of energy	£17,182	4·12d.	£34,066	4·07d.	−·05d.
Meter rents	832	·20d.	2,155	·26d.	+·06d.
Sale of lamps, &c.	16	...	...	...	...
Sundry	251	·06d.	...	...	−·06d.
Gross revenue ...	£18,281	4·38d.	£36,221	4·33d.	−·05d.

The costs being, as stated, between dissimilar periods, cannot very well be discussed, but it will be seen that "oil, waste," is on the down grade—·04d. for this item per unit is a good testimonial to Mr. H. Dickinson, the engineer. The enhanced price of coal must

be felt very acutely by works situated in positions where a year or two ago very cheap fuel was available. Works costs of under ¾d., and total costs under 1½d. are remarkable performances. Leeds, again, has not the advantage of much street lighting. One only represents the public arc lighting, and the sales on this account amounted to 1,000 units last year.

COST OF PRODUCTION.

	1898.* Gross.	Per unit.	1899. Gross.	Per unit.	Increase.
Coal	£780	·19d.	£2,592	**·31d.**	+·12d.
Oil, waste, water and engine room stores	284	·07d.	361	**·04d.**	−·03d.
Salaries and wages incurred in generation and distribution	953	·23d.	2,099	**·25d.**	+·02d.
Repairs and maintenance of buildings, engines, boilers, dynamos &c.	478	·11d.	1,113	**·13d.**	+·02d.
Works cost ...	£2,495	·60d.	£6,165	**·73d.**	+·13d.
Rent, rates and taxes ..	322	·08d.	890	**·11d.**	+·03d.
Management expenses, salaries of managing engineer, secretary, clerks, &c.	1,045	·25d.	2,223	**·27d.**	+·02d.
General establishment charges, stationery and printing, law charges and insurance	316	·07d.	652	**·08d.**	+·01d.
Other expenses	...	...	...	...	...
Total costs ...	£4,178	1·00d.	£9,930	**1·19d.**	+·19d.

* October, 1898, to March, 1899. Six months only.

The gross profit of £26,000 has to provide over £12,000 for interest and nearly £6,000 for sinking fund (to which no previous contribution was made). The £8,000 odd difference is the surplus, and a handsome figure it is from a sale of only 2,000,000 units.

It would be an advantage if the Leeds Corporation would issue the accounts in the Board of Trade form. Modifications of this form are seldom improvements.

PROFIT STATEMENT.

	1898.	1899.
Interest on loans	£6,256	£12,473
Sinking fund for repayments	...	5,316
Net profit carried forward	7,847	8,502
Gross profit	£14,103	£26,291

Yarmouth Corporation Electricity Accounts.

THE accounts for last year of the municipal electricity supply at Yarmouth are pleasant reading, inasmuch as they show that a net loss of over £50 has been turned into a net profit of considerably over £400. The condition of affairs disclosed is better than might have been anticipated, and it is interesting to note that in 1897 the net loss was £437, while last year the net profit was exactly the same figure. This equals ·35d. per unit sold, so it is a considerable change. The capital expenditure last year was more than double that of the previous one. The units turned out in excess of 1898 are rather more than the increase in 1898 over 1897, while the extra load is slightly less, showing an improving load factor.

GENERAL STATEMENT.

	1898.	1899.	Increase.
Total capital expenditure ...	£35,723	**£40,265**	£4,542
Number of units sold	243,669	**299,179**	55,510
Maximum load in KW.	267	**319**	52
Gross revenue	£5,165	**6,457**	£1,292
Gross expenditure...	£3,206	**£3,818**	£612
Gross profit	£1,959	**£2,639**	£680
Average price per unit sold ...	4·93d.	**5·01d.**	+·08d.

The following figures showing the position of affairs in the last three years are instructive:—

	Units generated.	Units. Public lamps.	Units. Private.	Total sold.	Maximum load.	Net profit.
1897 ...	271,420	69,240	120,760	190,000	213	−£437
1898 ...	333,731	78,500	165,169	243,669	267	−£57
1899 ...	410,959	81,259	217,920	299,179	319	+£437

In 1897 there were 72 public arc lamps, there are now 77. The revenue per unit, curiously enough, shows a tendency to rise. From all sources the figure per unit has gone up nearly $\frac{1}{10}$d.

REVENUE STATEMENT.

	1898. Gross.	Per unit.	1899. Gross.	Per unit.	Increase.
Sale of energy	£5,002	4·93d.	**£6,238**	5·01d.	+·08d.
Meter rents	163	·16d.	**202**	·16d.	·00d.
Sale of old material	...	...	**4**	·00d.	...
Sundry fees, &c.	...	...	**13**	·01d.	+·01d.
Gross revenue ...	£5,165	5·09d.	**£6,457**	5·18d.	+·09d.

The costs are steadily coming down, and with the exception of "coal" and "management salaries," in which there are slight increases, and "oil, waste, &c.," which is unaltered, all the items show a drop. The change is shown by the figures given:—

	1897.	1898.	1899.
Works cost	2·56d.	2·43d.	2·35d.
Total cost	3·34d.	3·16d.	3·06d.

"Wages" and "repairs" are particularly moderate for a small station, and we congratulate Mr. Gordon Bryant, the borough electrical engineer, upon these results. The works are obviously assessed much higher than before; in 1897 the sum of £66 covered everything under this head.

Under "wages" we have included the cost of attending, trimming, and repairing the public lamps, as the details are not given. Excluding this addition to the station wages, the figure is £468, which works out at ·375d. per unit.

COST OF PRODUCTION.

	1898. Gross.	Per unit.	1899. Gross.	Per unit.	Increase.
Coal, and unloading same..	£1,311	1·29d.	£1,687	**1·35d.**	+·06d.
Oil, waste, water and engine room stores.	318	·31d.	379	**·31d.**	·00d.
Salaries and wages incurred in generation and distribution, and attending, repairs, renewals of public lamps and carbons.	598	·59d.	646	**·52d.**	−·07d.
Repairs and maintenance of buildings, engines, boilers, dynamos, &c.	245	·24d.	214	**·17d.**	−·07d.
Works costs ...	£2,472	2·43d.	£2,926	**2·35d.**	−·08d.
Rent, rates and taxes ..	169	·17d.	200	**·16d.**	−·01d.
Management expenses, salaries of managing engineer, secretary, clerks, &c.	435	·43d.	563	**·45d.**	+·02d.
Establishment charges, stationery and printing, law charges and insurance	130	·13d.	129	**·10d.**	−·03d.
Other expenses	...	...	...	...	...
Total costs ...	£3,206	3·16d.	£3,818	**3·06d.**	−·10d.

In the profit statement it is shown that a part of last year's surplus is devoted to wiping out the deficit in 1898, a small sum is put aside to cover possible bad debts this year, and the remainder is carried forward. In 1898 the financial charges absorbed £2,016, and last year took £186 more, or £2,202.

PROFIT STATEMENT.

	1898.	1899.
Interest on loans	£1,029	£1,141
Sinking fund for repayments	987	1,061
Net profit carried to cover last year's deficit ..	...	57
" " cover bad debts in 1900 ..	...	9
" " forward	−57	371
Gross profit	£1,959	£2,639

CITY NOTES.

Eastern Extension, Australasia, and China Telegraph Company, Limited.

SIR JOHN WOLFE BARRY, K.C.B. (chairman), presided on Wednesday afternoon at Winchester House, Old Broad Street, over the fifty-fourth half-yearly ordinary general meeting of the above company, and, in moving the adoption of the report, said that that being the first time that he had had the pleasure of meeting the shareholders as chairman, he wished to bespeak from them every consideration in his arduous duties of representing the company. They ought also to recognise the great services of the late chairman, the Marquis of Tweeddale, who was, they were glad to say, continuing his work on the board. The gross revenue of the company had amounted to £313,000, against £324,000 in the corresponding period of 1899, which on the face of it appeared to indicate a decrease of £11,000. That was only an apparent decrease, for, on the contrary, there had been an increase amounting to about £5,000, and the reason why the figure appeared to be a decrease was that during the half-year they had received less by £16,200 than they had last year in consequence of the termination of the Australian subsidy. On the other hand, they were relieved from the payment of £25,545 in former years, which was applied to sinking fund to deal with the termination of the subsidy. They had, therefore, only contributed in the present year £7,583, and were really a great deal better off than they were as far as the traffic of the cables was concerned. When the debenture debt was paid off, as it would be in the course of the present year, the revenue account would be benefited to the extent of about £18,000 per annum. The working expenses had amounted to £108,660, as against £107,266, an increase of £1,304. That increase was accounted for by the contribution to the pension fund, which had been remodelled in accordance with the arrangement which had been made, and certain expenses connected with negotiations which had taken place in the half year. They were in a position to pay £62,500 in the usual dividends, and were able to transfer £100,000

to general reserve, and £5,000 to reserve fund in connection with the removal of the head office, and there remained a balance of £16,832, which was carried forward to next account, as against £13,000 carried forward in the previous half-year. As they were aware, the unissued balance of 50,000 shares of the company's share capital was allotted a few months ago to the shareholders at a premium of £3 per share, or £13 each, the object being to provide funds towards meeting the company's financial obligations in connection with the Cape-Australian cable contract. The whole of the shares were taken up, and an official settlement and quotation had recently been obtained. The shares now stood at about £1 premium, and after December 31st next they would rank *pari passu* with the old shares in regard to dividend. It would be seen from the report and accounts that the Tasmanian duplicate cable was partially renewed during the half-year at a cost of £13,239, and that the general reserve fund had been debited with this amount. The work was carried out by means of the company's local resources, otherwise it would have entailed a much larger expenditure. The advantage of keeping an adequate supply of spare cable in the Far East was clearly demonstrated during the recent outbreak of troubles in China, when owing to the intermittent working of the Chinese landlines between Shanghai and Peking, submarine cable communication was urgently required by the Allied Forces to enable them to communicate with their Governments. Fortunately this company and the Great Northern Company had accumulated large stocks of cable at Singapore, Hong Kong and Shanghai, and, having ships on the spot, they were able to promptly meet the requirements, not only of the British Government in connection with the Wei-hai-Wei, but of the general public and foreign Governments. Had they not been so fortunately situated at this critical juncture, the strong position which they now occupy in China might have been seriously imperilled. After the many statements that have recently appeared in the newspapers respecting the all-British Pacific cable, they would no doubt expect him to make a few remarks on the subject. The latest important development was the public invitation for tenders, which had to be sent in not later than August 14th last; and, although the result had not yet been officially announced on this side, the Premier of New South Wales had informed the Parliament of that Colony that the Imperial Government had recommended the acceptance of the Telegraph Construction and Maintenance Company's tender—amounting, with cost of stations, apparatus, maintenance ship, &c., to nearly two millions sterling. This was for a single line of cables, and included only one maintenance ship. A Bill had accordingly been passed through the New South Wales Parliament, authorising the Government to bear their share of the proposed expenditure. They understood that a similar Bill would have to be passed by the Victorian Parliament before the tender can be accepted; and, as the new Victorian Parliament was expected to meet next week, we assume that in a very short time the Pacific Cable Committee would be in a position to conclude a contract for the manufacture and laying of the cable. In any case, however, two years at least must elapse before the cable could be opened for traffic; and, with its enormously long stretch between Vancouver and the Fanning Island (3,671 nautical miles), the cable would necessarily be a very slow one. Consequently, with their vast network of cables, and the additional facilities which the new Cape-Australian cable could afford, they did not fear the result of the threatened competition. As regards the tariffs, they had already arranged to reduce—on a standard revenue basis—down to 2s. 6d. a word, or 6d. below the minimum tariff which they understand the Pacific Cable propose to accept. The tariff to South Australia and the other contracting colonies was reduced on May 1st last from 4s. 9d. to 4s., and as the standard revenue has been maintained, there would be a further reduction on January 1st next of 6d., making the rate 3s. 6d. per word. Should the standard revenue still be maintained, the tariff would be further reduced to 3s. on January 1st, 1902, and to 2s. 6d on January 1st, 1903. The first section of the Cape-Australia cable, viz., between Durban and Mauritius, was expected to be laid early next year, and the whole line ought to be completed and opened for traffic by the end of 1901.

The Marquis of Tweeddale seconded the motion for the adoption of the report, and it was carried.

It was also agreed, on the motion of Mr. John Newton, that a vote of thanks be passed to the Marquis of Tweeddale, and that it be left to the board to recognise his services in any way they thought proper.

Brisbane Electric Supply Company, Limited.

The eighth half-yearly report of this company was presented at the meeting held on September 20th. It states that the position of the company has considerably improved, and that the improvement is not merely on paper, but has taken the more tangible form of reduction of liabilities—the bank overdraft having been reduced by nearly £1,200, and the sundry creditors having been reduced by over £700—while the assets of the company have not altered materially since the annual meeting in March last. "At that time the benefits expected from the removal from Edison Lane to Ann Street, and from the expenditure in new plant, had not yet accrued, and the profits were balanced by the heavy writing off of the discarded Edison Lane plant. But this half-year shows clearly the advantage derived from the new station, and the hopes expressed at last meeting have been fully justified, particularly in regard to works cost per unit, which is a little over half the amount incurred at Edison Lane. The business is still expanding and fresh customers coming in every week, so that the new 50-kw Parker set by the ss. *Itola*, due this month, will be at work none to soon to cope with the load. The output for the half-year was 125,000 units (equivalent to 250,000 per annum), and the revenue for the same period from all sources was £2,933 (equivalent to £5,800 per annum)."

The West India and Panama Telegraph Company, Limited.

The directors' report for the half-year, to be presented at the meeting to be held on 15th inst., reads:—

The directors submit the accounts for the six months ended June 30th, 1900. The amount to credit of revenue is £27,737 17s., against £30,929 10s. 8d. for the corresponding half-year of 1899, and the expenses have been £21,731 11s. 10d., against £21,491 9s. 8d., leaving a balance of £6,006 5s. 2d. The directors must express their regret at this inadequate result, which is attributable to low rates and the continued unsatisfactory condition of West India trade. To the profits of £6,006 5s. 2d. for the half-year there is to be added interest on investments amounting to £2,787 12s. 7d., making, with £279 6s. 9d. brought forward from last account, a total of £9,023 4s. 5d. to the credit of revenue. The cumulative dividends for the half-year on the first and second preference shares amount to £11,769 12s., and towards meeting these dividends a further sum of £2,746 7s. 7d. is required. It was pointed out in the last half-yearly report that there was a substantial increase over cost in value of the investments of the reserve fund; this is still fortunately the case, and the directors again recommend that the cumulative preference dividends be paid, and that a dividend of 6d. per share (free of income-tax) be paid on the ordinary shares, and for this purpose the sum of £6,000 has been transferred from the reserve, leaving £953 11s. 11d. to be carried forward to the current half-year's account. This will still leave the value of the investments greater than their cost, as shown in the accounts. In the last report the directors stated that they had addressed the Secretary of State for the Colonies, pointing out the position of the company, and asking for Imperial aid. To that application a reply from Mr. Chamberlain was received, expressing regret at his inability to recommend a grant to the company from the Imperial funds. As this grant would have been in the nature of aid to West India commerce, by enabling the company to maintain its existing low tariffs, the directors, feeling that the company had a strong claim upon the Government, laid before Mr. Chamberlain further statements regarding its position, the originating causes of it, the great value of the system to the Imperial Government and the Colonies, and solicited a reconsideration of the company's appeal. To these further communications a reply from Mr. Chamberlain was received on the 26th ult., stating that, after full consideration and consultation with the Lords Commissioners of the Treasury, he regrets that he cannot reconsider his decision. The directors will have to carefully consider this decision, with a view to taking future action in the interests of the company. A copy of the correspondence with the Colonial Office is enclosed herewith. The company's duplicate system, comprising 24 cables, of a total length of 4,689 knots, continues in good working order.

Prospectuses.

The list of subscriptions to the Electrical Power Distribution Company was to close yesterday. The issue consisted of 12,980 £10 ordinary shares at £1 premium, and was offered on behalf of the British Electric Traction Company and the Brush Electrical Engineering Company by the Electric and General Investment Company. The nominal capital is £300,000 in £149,800 ordinary, and £150,000 preference, and £200 deferred (£1 shares), and of this there is already issued and paid up £20,000 ordinary and £200 deferred. The position of the deferred shares is that after the ordinary have received 10 per cent., one moiety of the surplus profits available for distribution goes to them. The deferred share rights may be extinguished within 10 years for £10,000 cash. They are held by Messrs. E. Garcke, W. L. Magden, J. S. Raworth, and R. P. Sellon.

The company was formed in 1898 with a nominal capital of £20,200, the whole of which has been paid up, for the purpose of securing and working concessions for electrical power distribution. The prospectus stated:—

In many of the industrial and other districts of the United Kingdom there is wide scope for the supply of electrical energy for lighting, tramways, light railways, and other power purposes. Considerable economy can be effected in the generation of electricity by combining the supply for these various purposes, and an agreement has been made with the British Electric Traction Company, Limited, under which that company will, whenever possible, co-operate with this company and take electrical energy for their tramways and light railways from the power stations of this company. The operations of the company will comprise the construction and working of electric power distribution undertakings in various localities, the promotion and acquisition of powers for such undertakings, and the supply of electric energy in bulk to other authorised undertakers. These operations may be carried on by the company itself or by means of associated companies formed for the purpose. From these and other sources the directors believe that large profits will be realised. The policy of the directors will be to reserve to the company a substantial interest in each associated undertaking, and they will use their influence and well-known experience in electrical work to ensure economical administration.

The prospectus contained particulars of various electric lighting and tramway powers which have been obtained for the county of Durham (the County of Durham Electric Power Supply Act, 1900); the North Metropolitan District (Electric Power Supply Act, 1900); the county of Surrey, and other places.

Numerous contracts have been entered into, and particulars of these are given with the prospectus. The directors of the company are J. S. Raworth (chairman), W. L. Madgen (managing director), C. S. Hilton, R. P. Sellon. The secretary and offices are:—G. J. Somerville, Surrey House, Victoria Embankment, W.C.

Another company which has this week been before the public, and whose list closed yesterday, is Messrs. Richardsons, Westgarth and Co., Limited, marine and electrical engineers, boiler makers, &c. The company, with a capital of £700,000 and £350,000 4½ per cent. perpetual debenture stock, is to amalgamate and concentrate under one management the businesses of Thomas Richardson and Sons, Limited, of Hartlepool (the sole representatives in this country of Brown, Boveri & Co., of Baden); Sir Christopher Furness, Westgarth & Co., Limited, of Middlesbrough; and William Allan & Co., of Sunderland. £200,000 ordinary shares (£1), and £150,000 6 per cent. preference (£1), and £100,000 debentures, have been applied for by shareholders and directors in the amalgamating companies, and the remainder has been offered for public subscription. The issue will provide £200,000 in cash for working

capital and extensions. After 8 per cent. has been paid on the ordinary capital, the residue of the profits each year will be held in reserve until £100,000 is accumulated, and this amount will remain primarily for the security of the preference shareholders.

The London United Tramways Company, whose enterprising undertakings are by this time familiar to most people in the electrical world, has this week been offering for subscription £350,000 4 per cent. first mortgage debenture stock. So far, upon the electrical equipment of the first sections to be taken in hand, and the equipment of the Chiswick generating station, and so on, the expenditure has been over £500,000. This is for 16 miles of route, of which 11 are now about to be put into operation, the other five being expected to be finished by next summer. A further outlay upon these sections will be incurred, amounting to about £300,000, making a total capital outlay of £800,000, which will be a security for these debentures. The economy and other advantages from electrical working are expected to lead to large profits. The list closed on Tuesday.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—Tuesday, November 13th. Davis and Timmins, Limited.—20,000 vendors' ordinary shares of £1 each, fully paid, Nos. 27,001 to 47,000. Pearson Fire Alarm System, Limited.—Further issue of 4,300 shares of £1 each, fully paid, Nos. 140,001 to 140,300. Willans & Robinson, Limited.—Further issue of 10,000 ordinary shares of £5 each, (issued at £3 per share premium), £2 paid (of which £1 is capital, and £1 premium), Nos. 90,001 to 100,000; and 10,000 6 per cent. cumulative preference shares of £5 each (issued at £1 per share premium), £2 paid (of which £1 is capital, and £1 premium), Nos. 70,001 to 80,000, and has also ordered the undermentioned securities to be quoted in the Official List:—City of Buenos Ayres Tramways Company, Limited.—Further issue of 20,000 shares of £5 each, fully paid, Nos. 135,001 to 155,000. Willans & Robinson, Limited.—Further issue of 10,000 6 per cent. cumulative preference shares of £5 each, fully paid, Nos. 60,001 to 70,000.

Bristol Tramways Company.—The directors have elected Mr. George White chairman of the company. Mr. Samuel White takes Mr. Low's seat, and succeeds Mr. George White as managing director of the company. Mr. J. Clifton Robinson, C.E., was elected to the vacancy created by the death of the late Mr. William Butler, and Mr. Henry F. Cooper (who has been assistant secretary for some years) has been appointed secretary to the company.

The New Zealand Electrical Syndicate, Limited.—Warrants for the half-year's interest on the 6 per cent. first mortgage debentures, and for the half-year's dividend on the 7 per cent. cumulative preference shares have been posted.

British Electric Traction Company.—The interim report just issued states that an interim dividend on the ordinary shares at 6 per cent. per annum for the half-year ended September 30th will be paid on December 22nd.

Kidderminster and District Electric Lighting and Traction Company.—The transfer books and register of members will be closed from 7th to 15th inst. inclusive.

TRAFFIC RECEIPTS.

The Blackpool and Fleetwood Tramroad Company.—The receipts for the week ending November 3rd, 1900, were £205; corresponding period last year, £189; increase, £16. Total to date, £19,086; corresponding period last year, £19,061; increase, £25.

The Bristol Tramways and Carriage Company.—The receipts for the week ending November 2nd, 1900, were £2,897 7s. 4d.; corresponding period last year, £3,139 7s. 8d.; decrease, £242 10s. 4d.

The Central London Railway.—The receipts for the week ending November 3rd, 1900, were £6,564; previous week, £6,102; increase, £462. Total receipts to date (14 weeks), £71,062. Miles open, 6.

The City and South London Railway Company.—The receipts for the week ending November 4th, 1900, were £1,936; corresponding week last year, £1,045; increase, £891. Total to date, £28,394; corresponding period last year, £17,344; increase, £11,0 0. Miles open, 1900, 4½; 1899, 3½.

The Cork Electric Tramways and Lighting Company.—The receipts for the week ending November 1st, 1900, were £384 3s. 1d.; corresponding week last year, £353 15s. 1d.; increase, £30 8s. 0d. Total to date, £18,261 1s. 3d.; corresponding period last year, £16,766 14s. 8d.; increase, £1,494 6s. 7d.

The Dover Corporation Tramways.—The receipts for the week ending November 3rd, 1900, were £187 17s. 2d.; corresponding week last year, £175 13s. 11d.; increase, £12 3s. 3d. Total to date, £9,244 4s. 0½d.; corresponding period last year, £8,818 17s. 10d.; increase, £425 6s. 2½d. Miles of track open, 3. Car miles run, 1900, 4,968; 1899, 4,756. Number of cars, 11.

The Dublin United Tramways Company.—The receipts for the week ending November 2nd, 1900, were as follows:—D. U. T. Co., horse cars, £26 2s. 9d.; ditto, electric cars, £3,465 16s. 9d.; D. S. D. Co., electric cars, £705 12s. 10d.; total, £4,197 12s. 4d; corresponding week last year—D. U. T. Co., horse cars, £207 9s. 10d.; ditto, electric cars, £2,871 13s. 4d.; D. S. D. Co., electric cars, £692 8s. 6d.; total, £3,671 11s. 8d.; increase, £526 0s. 8d.; aggregate to date, £86,914 14s. 7d.; aggregate to date last year, £77,813 17s. 5d.; increase, £9,100 17s. 2d. The mileage worked is 44 miles electrically, 1 mile by horses, as against 35 miles electrically, 9 miles by horses, for the corresponding period last year.

The Liverpool Overhead Railway Company.—The receipts for the week ending November 4th, 1900, were £1,561; corresponding week last year (includes date of embarkation of 10th Hussars for South Africa), £1,873; decrease, £312. Total from July 1st, 1900, £80,455; ditto corresponding period last year, £29,677; increase, £778. Miles open, 6·57 chains.

STOCKS AND SHARES.

Wednesday Evening.

After our own election, the American. The polling across the herring pond has so greatly engaged the attention of Stock Exchange operators on this side that they have found time to devote to little else besides securities likely to be affected by its result. The Anglo-American telegraph market has benefited to a small degree, the "B" stock more particularly, the price having risen 1 per cent., and, as we pointed out a fortnight ago, possesses a fair chance of further improvement. The majority of changes in the telegraph department are in the upward direction. Electricity supply shares are almost unaltered, and in the railway section the tone is heavy.

Two promotions of peculiar importance to those interested in electricity have been made during the week. Last Saturday the London United Tramways Company announced an issue of £350,000 4 per cent. First Mortgage Debenture stock at par. The prospectus reads excellently, and the premium of 3 to 5 per cent. established by the market seems to us to be fully justified. As the stock is redeemable at 105 in 1920, we do not anticipate any further advance in price until the Money Market becomes easier. The second issue to which we refer is the Electrical Power Distribution Company, Limited, which appealed for £129,800 in ordinary share capital. The shares of £10 each are offered by the British Electric Traction Company and the Brush Electrical Engineering Company at a premium of £1 each, the calls being spread over a period of eight months. A "cleaner" prospectus has not been published for some time, there being no waive clause, the agreements set out at length, promotion money frankly stated, and so on.

We have heard some alarm manifested at the way in which capital is now being invited for the purposes of supplying power for electric traction and the like. Critics object, for instance, to this new Electrical Power Distribution Company, with its nominal share capital of £300,000. But these gentlemen appear to overlook the wide scope there exists in Great Britain for such undertakings. Let the objectors look at the capital outstanding for traction enterprises in England, and see how it compares with that of similar companies in New York, Berlin, Paris and other centres, in America or on the Continent. This country is only just awakening to the possibilities of the new haulage power, and capital must surely be forthcoming to develop it.

From buying up all the Electricity Supply Debentures in the market, investors have gone on to similar securities in the telegraph list. There appears to be a growing demand for these stocks, and as many of them are on a fairly cheap level, no valid reason can be assigned why the purchases should not spread still further in this market. As regards stocks other than pre-Ordinary, there is an advance in Anglo "B," as we have already observed, and a corresponding shrinkage of 1 per cent. in Eastern Telegraph Ordinary. We do not suppose that the latter has anything to do with the company's generous reduction in the tariff rates for relatives of soldiers serving in the Far East. Indo-European shares—amongst the most solid of their class—are £1 higher, recovering the dividend deducted on October 26th, and a little more into the bargain.

Determined attempts were made early in the week to "smash" the price of National Telephone shares. Lines of 500 and 1,000 were lustily offered in market overt, and at one time the quotation fell to 4½. It was quickly realised that these were mainly bear tactics, and the price advanced to 4⅝, with hardly a share changing hands. National Telephones have not been the centre of so much dramatic excitement for a long time. United River Plate Telephone new shares are 3¼—3⅜, £3 10s. paid, which is about the same price, proportionately, as those of the old. The Consolidated Telephone squabble has simmered down for the time being.

All shareholders in the Cape Electric Tramways Company should make a point of attending the meeting next Wednesday to protest against the unlimited power which the directors propose to assign themselves in making the new issue of shares. We referred briefly to the matter last week, and are glad to see that our line has since been followed by the *Westminster Gazette*, by the *Daily Mail*, and the *Financial News*. We do not for one moment suggest that the Cape Electric Board would make anything but good use of its powers, but the precedent which it thinks of setting can only be regarded as a dangerous one for shareholders as a body.

The Electric Railway market is irregular, but pronounced weakness became evident in City and South London on the appearance of a small seller, who only got 54 for his stock. Central Londons keep up well, their "C.I.V. traffics" helping the price. A rise of 5s. has brought the Preferred Halves into line with the Deferred. The issue of the Baker Street and Waterloo Railway prospectus is imminent. The share capital will be £2,350,000, and there are also borrowing powers for nearly £1,000,000 more.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1897.	1898.	1899.	Closing Quotation October 31st.	Closing Quotation November 7th.	Business done during week ended November 7th, 1900. Highest.	Lowest.
110,900	African Direct Telegraph, 4 % Debs.	100	...	...	...	99 —103	99 —103	...	...
125,000	Amazon Telegraph 5 % Debs., Nos. 1 to 1,250 Red. ...	100	...	...	...	85 — 90	85 — 90	...	...
875,520	Anglo-American Telegraph	Stock	3 %	£3 9s.	73/6	52 — 54	52 — 54	52¼	...
3,062,240	Do. do. 6 % Pref.	Stock	6 %	6 %	6 %	96 — 98	97 — 99	99¼	96½
3,062,240	Do. do. Deferred	Stock	...	18s. %	£1 7s.	10½— 10¾	10½— 10¾	10 9/16	10⅜
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	3 %	4 %	3 — 3½	3 — 3½	...	...
10,000,000$	Commercial Cable	$100	8 %	8 %	8 %	165 —175	165 —175	...	...
1,563,078£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	101 —103	101 —103	103	101½
16,000	Cuba Telegraph	10	7 %	8 %	7 %	6½— 7¼xd	6½— 7½	7¼	...
6,000	Do. 10 % Pref.	10	10 %	10 %	...	14½—15½xd	14½— 15½	...	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	4 %	3½— 4½	3½— 4½	...	...
6,000	Do. do. 10 % Cum. Pref.	5	10 %	...	...	9 — 10	9 — 10	...	...
30,000	Do. do. 4½ % Debs.	50	...	...	...	100 —104%	100 —104 %	...	...
60,710£	Direct United States Cable	20	3¼%	3¼%	3 %	10½— 10¾	10½— 10¾	10⅝	...
111,000	Direct West India Cable, 4½ % Reg. Deb.	100	...	...	...	99 —102	99 —102	...	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	149 —154	148 —153	150½	149
1,795,000	Do. 3½ % Pref. Stock	100	...	...	...	99 —102	98 —101	...	...
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	...	...	113 —118 xd	113 —118	113¾	113
250,000	Eastern Extension, Australasia, and China Telegraph ...	10	7 %	7 %	7 %	14⅜— 15¼	14⅜— 15¼	15 1/16	14⅞
6,700£	Do. 5 % (Aus. Gov. Sub.) Deb., 1900, red. ann. drgs., reg. 1—1,049, 3,976—4,326	100	5 %	...	...	... — ...	... — ...	...	...
26,600£	Do. do. Bearer, 1,050—3,975, 4,327—6,400	100	5 %	...	...	... — ...	... — ...	...	...
320,000£	Do. 4 % Deb. Stock	Stock	4 %	...	...	114 —119	114 —119	...	...
300,000£	Eastern and South African Telegraph, 4 % Mort. Deb. Nos. 1 to 3,000, red. 1909	100	...	...	...	99 —102	100 —103	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	...	...	...	100 —103%	99—102%xd	...	...
180,227	Globe Telegraph and Trust	10	4½%	5⅛%	5¼%	10½— 11	10½—11	10 13/16	10 11/16
180,042	Do. do. 6 % Pref.	10	6 %	6 %	...	15 — 15½	15 — 15½	15⅝	15⅛
150,000	Great Northern Telegraph, of Copenhagen	10	10 %	12½%	...	31 — 33	31 — 33	...	...
84,300	Halifax and Bermuda Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	98 —101	98 —101	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	48 — 52 xd	49 — 53	51¾	50¼
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	6 %	...	...	103 —106	104 —107	...	...
72,680	Montevideo Telephone, Limited, Ord., Nos. 1 to 72,680 ...	1	...	...	2½%	¼— ½	¼— ½	...	...
86,492	Do. do. do. 5 % Pref., Nos. 1 to 86,492	1	4 %	4 %	5 %	¾— 1	¾— 1	...	...
490,000	National Telephone, 1 to 490,000	5	6 %	6 %	5 %	4⅛— 4⅜	4⅛— 4⅜	4 5/16	4 3/16
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	13 — 15	13 — 15	...	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	13 — 15	13 — 15	...	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	6 %	5 — 5¼	5 — 5¼	5 3/16	...
2,000,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	96 — 99	96 —99	97½	96½
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	5 %	5 %	⅞— 1⅛xd	⅞— 1⅛	⅞	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 ...	100	4 %	...	...	100 —103	101 —104	...	...
11,839	Reuter's	8	5%	5 %	5 %	7 — 8	7 — 8	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	125 —130	126 —131	126½	...
58,000	United River Plate Telephone	5	5 %	6 %	7 %	4⅜— 5¼	4⅜— 5¼	...	...
16,639	Do. do. 5 % Cum. pref. Nos. 1—16,639	5	...	...	...	4⅜— 5¼	4⅜— 5¼	...	...
179,947	Do. do. 5 % Debs.	Stock	...	...	...	104 —107	104 —107	...	...
200,000£	West African Telegraph, 5 % Debs....	100	...	...	...	98 —101	98 —101	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	¼— ⅜	¼— ⅜	...	...
150,000	Do. do. 4 % Debs., 1—1,500 gua. by Braz. Sub. Tel.	100	...	...	...	100 —103	100 —103	...	...
389,731	Western and Brazilian Telegraph 4 % Deb. Stock Red. ...	Stock	...	...	...	... — ...	... — ...	...	...
207,930	Western Telegraph, Ltd., Nos. 1—207,930	10	7 %	7 %	7 %	14½— 15	14½—15	14⅛	14¼
75,000	Do do. 5 % Debs. 2nd series, 1906 ...	100	...	...	...	103 —106	103 —106	...	...
88,321	West India and Panama Telegraph	10	¾%	2 %	⅝%	¾— 1	¾— 1	1 1/16	...
34,563	Do. do. do. 6 % Cum. 1st Pref. ...	10	6 %	...	...	6½— 7¼	6½— 7¼	...	...
4,669	Do. do. do. 6 % Cum. 2nd Pref. ...	10	6 %	...	...	6 — 7	6 — 7	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	...	...	105 —108	105 —108	...	...

ELECTRICITY SUPPLY COMPANIES.

19,661	Brompton & Kensington Elec. Lt. Sup., Ord., 101 to 19,761	5	4 %	6 %	6 %	7 — 8	7 — 8	...	...
12,000	Do. do. 7 % Cum. Pref....	5	7 %	...	...	8½— 9½	8½— 9½	...	...
50,000	Charing Cross and Strand Electricity Supply	5	7 %	8 %	9 %	9½— 10½	9½— 10½	10	9¾
20,000	Do. do. do. do. 4½% Cum. Pref.	5	...	...	...	5½— 6	5½— 6	...	...
34,000	*Chelsea Electricity Supply, Ord.	5	6 %	6 %	6 %	6 — 6¼	6 — 6¼	6 7/16	6⅜
150,000	Do. do. do. % Deb. Stock Red. ...	Stock	4½%	...	...	110 —113	110 —113	111¾	111½
60,000	City of London Electric Lighting, Ord. 40,001—100,000...	10	10 %	6 %	4 %	8½— 9½	8½— 9½	9⅛	...
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	...	12½—13½	13 — 13½	13½	13¼
400,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	5 %	...	...	125 —130	125 —130	...	...
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	*nil*	*nil*	4 %	8½— 9½	8½— 9½	9⅛	9
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	...	11 — 12	11 — 12	...	...
200,000	Do. 4½ % Deb. Stock, Prov. Certs (all paid) Rd. ...	...	...	...	...	108 —111	108 —111	...	...
26,100	Edmundson's Elec. Corp., Ord. Shares	5	5 %	7 %	...	4½— 5	4½— 5	4 9/16	...
75,000	Do. do. 4½ % 1st Mort. Deb. Stock. ...	100	...	...	...	101 —104	101 —104	...	...
110,000	London Electric Supply Corporation, Limited, Ord. ...	3	...	...	...	1⅜— 2¼	1⅜— 2¼	...	...
49,840	Do. do. do. do. 6 % Pref.	5	...	6 %	...	4½— 5½	4½— 5½	...	...
250,000	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	100 —102	100 —102	...	...
85,000	Metropolitan Electric Supply, 101 to 62,500	10	6 %	5 %	5 %	13½— 14½	13½— 14½	13 13/16	13½
220,000£	Do. 4½% First Mortgage Debenture Stock	...	4½%	...	...	112 —115	112 —115	...	...
220,000	Do. 3½% Mort. Deb. Stock Red.	Stock	...	...	...	97 —100	97 —100	98¾	98½
6,452	Notting Hill Electric Lighting	10	6 %	6 %	7 %	15 — 16	15 — 16	...	...
40,000	St. James's and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	15 — 16	15 — 16	15⅝	15 5/16
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8 — 9	8 — 9	...	..
12,000	Smithfield Market Elect. Supply, Ord.	5	...	...	...	2 — 2½	2 — 2½	...	...
50,000	Do. do. 4 % Deb.	100	...	..	...	85 — 95	85 — 95	...	...
65,000	South London Electricity Supply, Ord.	5	...	...	...	2½— 3½	2½— 3½	...	...
79,900	Westminster Electric Supply, Ord., 101 to 80,000... ...	5	12 %	12 %	13 %	12 — 13	12 — 13	12½	12⅝

* Subject to Founders Shares.
Unless otherwise stated all shares are fully paid.
Dividends marked ‖ are for a year consisting of the latter part of one year and the first part of the next.

Quotations on Liverpool Stock Exchange.
‖ Dividends paid in deferred share warrants, profits being used as capital.

£312. Total from July 1st, 1900, £20,455; ditto corresponding period last year, £29,677; increase, £778. Miles open, 6·57 chains.

imminent. The share capital will be £2,350,000, and there are also borrowing powers for nearly £1,000,000 more.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1897.	1898.	1899.	Closing Quotation Oct. 31st.	Closing Quotation Nov. 7th.	Business done week ended Nov. 7th, 1900. Highest	Lowest
		‡							
20,000	British Aluminium 7 % Cum. Pref.	10	...	...	...	9 — 10	9 — 10	...	...
300,000	Do. do. 5 % 1st Mort. Deb. Stock Red. ...	Stock	...	...	...	91 — 95xd	91 — 95	...	...
30,000	British Electric Traction	10	...	6 %	...	13 — 14	13 — 14	13⅜	13⅜
50,000	Do. do. 6 % Cum. Pref.	10	...	...	...	12 — 13	12 — 13	12½	12½
200,000	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	120 —123	120 —123	122	...
85,000*l*	†British Electric Works Co., Ord. £1 shares, 50,001—135,000	...	...	...	...	⅜— ½	⅜— ½	...	...
50,000	† Do do. 6 % Cum. Pref., 1—50,000 ...	...	...	...	...	⅝— ¾	¼— ½	⅜	...
500	† Do. do. 4½ % 1st Mort. Deb.	100	...	...	...	97 — 99	97 — 99	...	...
40,000	British Insulated Wire Ord., Nos. 1 to 40,000	5	15 %	15 %	20 %	11 — 12	9½— 10½	...	...
27,500	Do. do. 6 % Cum. Pref. Nos. 1 to 27,000 ...	5	...	...	...	5⅜— 6¼	5⅜— 6¼	...	...
105,731	Brush Elecl. Enging., Ord., 1 to 90,000	2	3 %	5 %	6 %	1⅜— 1⅝	1⅜— 1⅝	...	...
105,731	Do. do. Non-cum. 6 % Pref., 1 to 90,000 ...	2	6 %	6 %	6 %	2 — 2¼	2 — 2¼	2 3/16	...
125,000*l*	Do. do. 4½ % Perp. Deb. Stock	Stock	...	...	...	106 —111	106 —111	...	...
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock ...	Stock	...	...	...	102 —104	103 —105	...	...
20,000	Callender's Cable Construction shares, Nos. 1—20,000 ...	5	12½%	15 %	15 %	12½— 13½	12½— 13½	12⅝	12½
20,000	Do. do. 5 % Cum. Pref.	5	...	...	...	5 — 5½	5 — 5½	5½	5
90,000	Do. do. 4½ % 1st Mort. Deb. Stock Red ...	S ock	...	...	...	110 —114	110 —114	...	...
213,533	Central London Railway, Ord. Shares	10	...	...	...	10 — 10½	10 — 10½	10½	10¼
61,033	Do. do. Pref. half-shares	5	...	...	...	4⅜— 5¼	5 — 5½	5¼	...
71,447	Do. do. Def. do.	5	...	...	...	5 — 5½	5 — 5½	5 5/16	5¼
855,000	City and South London Railway	Stock	1⅞%	2¼%	1⅞%	58 — 61	54 — 58	56	54
37,500	Do. do. Ord. shares Nos. 22,501 to 60,000 ...	10	...	...	...	5 — 6	5 — 6	...	...
32,098	Crompton & Co., Nos. 1 to 32,098	3	...	6 %	7½%	3⅜— 4¼	3½— 4	3 1/16	3 1/16
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red	...	...	...	...	99 —102	99 —102	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	6 %	6 %	6 %	1⅜— 2¼	1⅜— 2¼	...	...
17,139	Do. do. do. "A" Shares, 01—017,139 ...	5	6 %	6 %	6 %	3½— 4½	3½— 4½	...	...
344,023	Do. do. do. 4 % Deb. Stock Red ...	100	...	...	...	90 — 92	90 — 92	90½	...
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	6 %	2 — 2¼	2 — 2¼	2 3/16	...
25,000	Do. do. 7 % Cum. Pref., 1 to 25,000... ...	2	7 %	7 %	...	2⅜— 3¼	2⅜— 3¼	3	...
140,300	Do. do. 4 % Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	102 —105	102 —105	...	...
9,600*l*	Greenwood & Batley, 7 % Cum. Pref., 1 to 9,600	10	7 %	7 %	7 %	10 — 11	10 — 11	...	...
30,000	Henley's (W. T.) Telegraph Works, Ord.	5	12 %	14 %	15 %	12½— 13½	12½— 13½	12 1/16	12½
30,000	Do. do. do. 4½ % Pref.	5	7 %	7 %	...	5 — 5½	5¼— 5⅝	5¼	...
50,000	Do. do. do. 4½ Mort. Deb. Stock...	Stock	4½%	...	...	108 —112	108 —112	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	...	20 — 21	20 — 21	20⅝	20½
300,000	Do. do. do. 4 % 1st Mort. Deb	100	...	...	...	99 —102	99 —102	101½	101
37,500	†Liverpool Overhead Railway, Ord.	10	3½%	3½%	3½%	8⅞— 9	8¼— 9	...	...
10,000	† Do. do. Pref., £10 paid	10	5 %	5 %	5	12⅝— 13½	12⅝— 13½	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	36 — 40	36 — 40	37	36¼
150,000	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	...	...	...%	101 —104	101 —104	...	...
20,000	Telegraph Manufacturing, Ord. Nos. 1 to 20,000	5	...	8 %	12 %	10½— 11½	10½— 11½	...	...
20,000	Do. do. 5 % Cm. Prf. Nos. 1 to 20,000...	5	...	...	...	5¼— 5⅝	5¼— 5⅝	5½	...
540,000*l*	Waterloo and City Railway, Ord. Stock	100	...	3 %	3 %	94 — 97	92 — 95	93	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Brompton and Kensington, 4½ % Debentures of £100, 103—106.
National Electric Free Wiring, 12/6 paid, ⅜—½.
Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 16½—17½.
Do. do. Pref. (£10 pd.), 10—10½.
* From Birmingham Share List.

Kensington and Knightsbridge Electric Lighting, Ordinary Shares £5 (fully paid) 12—13; 1st Preference Cumulative 6 % £5 (fully paid), 6½—7½. Debentures, 102—105. Dividend, 1899, on Ordinary Shares 11 %.
*T. Parker, £10 (fully paid), 17½.

Bank rate of discount 4 per cent. (July 19th, 1900).

MARKET QUOTATIONS, Wednesday, November 7th.

CHEMICALS, &c.		This week.	Last week.	Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	5/-	..
a ,, Nitric	per cwt.	22/-	22/-	..
a ,, Oxalic	per cwt.	32/-	32/-	..
a ,, Sulphuric	per cwt.	5/6	5/6	..
a Ammoniac, Sal	per cwt.	39/-	39/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	£33 10	..
a ,, ,, ..	per ton	£30	£30	..
a Bleaching powder	per ton	£7	£7	..
a Bisulphide of Carbon	per ton	£15	£15	..
a Borax	per ton	£17 10	£17 10	..
a Bensole (90 %)	per gal.	7/-	7/-	..
a ,, (50/90%)..	per gal.	5/6	5/6	..
a Copper Sulphate	per ton	£25	£25	..
a Lead, Nitrate	per ton	£25	£25	..
a ,, White Sugar	per ton	£31	£31	..
a ,, Peroxide	per ton	£27 10	£27 10	..
a Methylated Spirit	per gal.	2/6	2/6	..
a Naphtha, Solvent (90% at 160°C).	per gal.	5/6	5/6	..
a Potash, Bichromate, in casks..	per lb.	3¼d.	3¼d.	..
a ,, Caustic (75/80%) ..	per ton	£24	£24	..
a ,, Bisulphate	per ton	£35	£35	..
a Shellac	per cwt.	64/-	64/-	..
a Sulphate of Magnesia	per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6	£6	..
a ,, Recovered	per ton	£5 10	£5 10	..
a ,, Lump	per ton	£5	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	£10 15	..
a ,, Crystals	per ton	£3	£3	..
a ,, Bichromate, casks ..	per lb.	2¾d.	2¾d.	..

METALS, &c.				
b Aluminium Wire, in ton lots..	per ton	£294	£294	..
b ,, Sheet, in ton lots	per ton	£191	£191	..
p Babbitt's metal ingots.. ..	per ton	£80 to £145	£80 to £150	..
c Brass (rolled metal 2" to 12") basis	per lb.	7¾d.	7¾d.	..
c ,, Tube (brazed)	per lb.	10d.	10d.	..
c ,, ,, (solid drawn) ..	per lb.	8¼d.	8¼d.	..
c ,, Wire, basis	per lb.	8¼d.	8¼d.	..
c Copper Tubes (brazed) ..	per lb.	11½d.	11½d.	..
c ,, ,, (solid drawn) ..	per lb.	11d.	11d.	..
g Copper Bars (best selected) ..	per ton	£86	£86	..

METALS, &c. *(continued.)*		This week.	Last week.	Inc. or Dec.
g Copper Sheet	per ton	£86	£86	..
g ,, Rod	per ton	£86	£86	..
e ,, (Electrolytic) Bars ..	per ton	£83 10	£83 10	..
e ,, ,, Sheets ..	per ton	£92	£93	..
e ,, ,, Rod ..	per ton	£85 10	£85 10	..
e ,, ,, H.C. Wire	per lb.	9¾d.	9¾d.	..
f Ebonite Rod	per lb.	3/-	3/-	..
f ,, Sheet	per lb.	5/-	5/-	..
n German Silver Wire	per lb.	1/6	1/6	..
h Gutta-percha fine	per lb.	8/6	8/6	..
h India-rubber, Para fine	per lb.	4/- to 4/1	4/- to 4/1	..
i Iron, Charcoal Sheets	per ton	£18	£18	..
i ,, Pig (Cleveland warrants) ..	per ton	65/3	64/5	10d. inc.
i ,, Forgings, according to size	per ton	From £11	From £11	..
i ,, Scrap, heavy	per ton	70/- to 72/6	70/- to 72/6	..
i ,, Wire, galvanised No. 8 ..	per ton	£11 15	£12 5	10s. dec.
g Lead, English Ingot	per ton	£17 10 to £17 12 6	£17 15 to £17 17 6	5s. dec.
g ,, ,, Sheet	per ton	£19	£19	..
m Manganin Wire No. 28	per lb.	8/-	8/-	..
g Mercury	per bot.	£9 5	£9 2 6	2s. 6d. dec
d Mica (in original cases), small ..	per lb.	3d. to 9d.	3d. to 9d.	..
d ,, ,, ,, medium	per lb.	1/9 to 2/9	1/9 to 2/9	..
d ,, ,, ,, large ..	per lb.	3/3 to 7/3	3/3 to 7/3	..
p Phosphor Bronze, plain castings	per lb.	1/1 to 1/4	1/1 to 1/4	..
p ,, rolled bars & rods	per lb.	1/1 to 1/4	1/1 to 1/4	..
p ,, ,, strip & sheet	per lb.	From 1/3	From 1/3	..
o Platinum	per oz.	£3 18	£3 18 6	4s. 6d. inc
p Silicium Bronze Wire	per lb.	10½d. to 1/1	10½d. to 1/1	..
i Steel, Magnet, acc'd'ng to desc'p'n	per ton	From £15	to £40	..
i ,, ,, in bars		£58	£58	..
g Tin, block	per ton	£132 to £133	£132 to £132 10	..
g ,, foil	per lb.	2/-	2/-	..
n ,, wire, Nos. 1 to 16	per lb.	1/9	1/9	..
p White Anti-friction Metals — "White Ant" brand	per ton	£40 to £70	£40 to £70	..
j Yarns, Cotton, Single 10 lb. b'ndl's	per lb.	9½d.	9½d.	..
j ,, Best Flax, 6 lea.	per lb.	6½d.	6d.	½d. inc.
j ,, Hemp, 3 ply 10 lbs. ..	per lb.	4½d.	4½d.	..
j ,, ,, Russian, 10 lbs. ..	per lb.	5½d.	5½d.	..
j ,, Jute, 180 lbs. rove ..	per ton	£14 10	£14 10	..
k Zinc, Sh't. (Vielle Montagne ond.)	per ton	£23 2 6	£24 5 nett.	22s. 6d. dec.

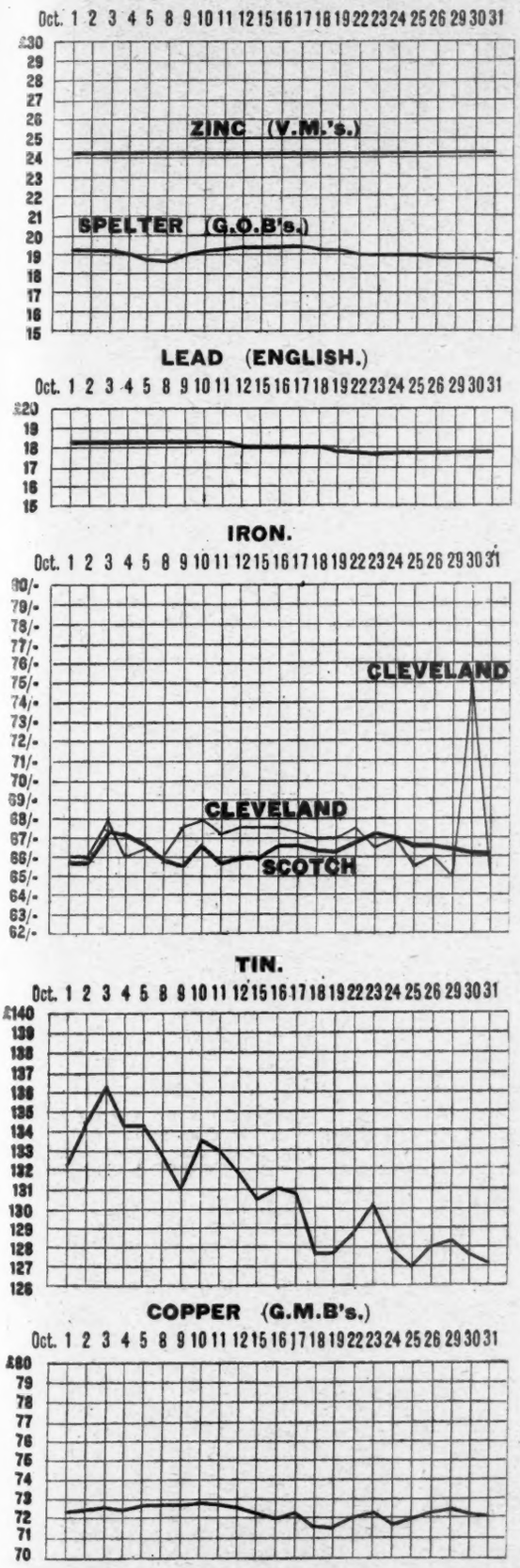
Quotations supplied by { *a* Messrs. G. Boor & Co. *b* The British Aluminium Co., Ltd. *c* Messrs. Thos. Bolton & Sons. *d* Messrs. F. Wiggins & Sons. *e* Messrs. Frederick Smith & Co.

Quotations supplied by { *f* India-Rubber, G.-P. and Teleg. Works *g* Messrs. James & Shakspeare. [Co., Ltd. *h* Messrs. Jackson & Till. *i* Messrs. Bolling & Lowe. *j* Messrs. Henry C. Yeo & Co.

Quotations supplied by { *k* Messrs. Morris Ashby, Limited. *m* Messrs. W. T. Glover & Co., Ltd. *n* Messrs. P. Ormiston & Sons. *o* Messrs. Johnson, Matthey & Co., Ltd. *p* The Phosphor Bronze Company, Ltd.

Unless otherwise stated all shares are fully paid. ‖ Dividends paid in deferred share warrants, profits being used as capital.
Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

METAL MARKET.—Fluctuations in October.



Burstall.—At a meeting of the D.C. last week, it was resolved to make application to the B. of T. for a prov. order authorising the Council to supply electric light and power within its district.

ELECTRIC TRAMWAYS AT GRIMSBY AND CLEETHORPES.

The Great Grimsby Street Tramways Company are making rapid headway towards the completion of their electric tramway for Grimsby and the neighbouring sea-side town of Cleethorpes. Throughout Grimsby the old track has been taken up, and new double track laid with heavy girder rails, which are bonded with Neptune copper bonds ready for electric traction. A new line of tramway has been constructed from Victoria Street to the Old Market Place, *vid* George Street, Osborne Street, and Bethlehem Street, in order, by this route, to provide a double line throughout, it being impossible to put down double line in the narrow part of Victoria Street. Further extensions are also provided for in the company's Act of Parliament.

The current for the tramways in the borough of Grimsby will be supplied from the electric power station, now being completed by the Corporation of Grimsby.

For the purpose of supplying current for the tramways in Cleethorpes, a power station is being erected on a plot of land abutting on Pelham Road, Cleethorpes, and a tramway depôt is also being erected on adjoining land. The engine room is 48 feet wide by 80 feet long, and 24 feet high to the roof plate. Adjoining this is the boiler house of a similar size, but 19 feet high to the roof plate, and at the extreme rear there will be the coal store 66 feet in length by about 31 feet in width, to which there will be a railway siding from the Great Central Company's Cleethorpes line. The battery room, for the purpose of electric lighting, will be in front of the engine house, and will be 25 feet wide by 45 feet long, and 15 feet high to the roof plate. The chimney shaft in connection with the power station is of sufficient size to be used not only in connection with the boilers, but for a refuse destructor as well, should the local authority decide to erect one on the adjoining land. The shaft is 140 feet in height from the ground level to the cap. The buildings are being constructed of local bricks, faced with red stocks, which will also be used for the external face of the chimney shaft. The engine room internal walls are faced with glazed bricks in three colours. The two engines are built by the Robb Engineering Company, Limited, Amherst, Nova Scotia, Canada. They are of the Robb-Armstrong automatic cut-off, tandem compound, side-crank type, and are capable of developing 250 I.H.P., with 125 lbs. initial pressure when cutting off at about ¼ stroke in the high pressure cylinder, and running at a speed of 200 revolutions per minute. There are two Wheeler Admiralty surface condensers, each with 400 square feet cooling surface, and mounted on a combined air and circulating pump with steel cylinders. The two boilers are of the Lancashire type, fitted with Galloway cone tubes, and are 28 feet long and 7 feet 6 inches in diameter. The switchboard consists of two generater panels, one total output panel, one feeder panel, one Board of Trade panel, and one station lighting panel, all being in black enamelled slate. On the top of each panel will be mounted an efficient lighting arrester. There are two compound non-condensing pumps, manufactured by the Blake & Knowles Steam Pump Works, London, the steam cylinders of which are arranged tandemwise, with the high pressure steam cylinder inside. There is also a Green's economiser, having 96 tubes, fitted with new patent improved gearing. There are two standard direct-coupled generators, having a rated capacity of 150 KW.

The line in Cleethorpes consists of two miles of double track, part of which is now in course of construction. Throughout, the centre poles for carrying the overhead equipment are to be 30 feet in length, and constructed to stand a test of 750 lbs. The terminal poles are to be capable of withstanding a strain of 1,500 lbs. In addition to the feeder cables there will be a three-core pilot and telephone cable running over the entire length of the line. The contractors for the power station and depôt are Messrs. Wilkinson & Houghton, of Cleethorpes; the track is being constructed by Mr. C. L. Duke, of Plymouth, and Messrs. Dick, Kerr & Co., Limited, London, are the contractors for the electric plant, overhead constructions, feeders, cables, &c.

Mr. John Glenn, C.E., of London, is acting as the tramway company's engineer, for the erection of the buildings, the laying of the track, and the putting down of the steam and electrical plant. It is proposed to have the whole of the lines ready for electric traction early in the new year.

RECENT AMERICAN STEAM ENGINE PRACTICE.

Practice in steam engineering in America, as with ourselves, has probably changed to meet new conditions rather than progress towards improved economy. Mr. Stanwood discusses late developments in *Cassier's Magazine*. He states that there is a tendency to reduce shaft lengths, or, rather, the distance from the centre line to the end of the main bearing in side-crank engines, by cutting down the length of the crank-pin, shortening the hub of the crank to two-thirds the shaft diameter, and making the crank-pin without a collar—an old method in English practice—and the main bearing box without flanges. These cut down the distance named from 25 to 33 per cent. Framing is made heavier, and cross head pins are enlarged to stop the cutting to which their small movement

of oscillation renders them subject. The obviously necessary increase of the diameter of centre-crank engine shafts to that found necessary on side-crank engines, especially where all power goes from one end as in direct-connected dynamos, has been undertaken, we are told, but we do not hear that steps have been taken to avoid placing the generator at the end opposite from the fly-wheel. Either this should be done or we ought to be told less about the terrific stresses in engines for traction work. In order to prevent uneven bearing stresses two bearings are preferred, and have led to very clumsy shafts. Some engines are now made with a central rope drum to drive arc machines, and two side shafts driven by a globe-bearing crank-pin, these shafts carrying each a generator.

The self-oiling Ball engine is simply an enclosed horizontal engine with splash lubrication. A vertical Ball engine is illustrated in which the shaft bearings are fixed in jaws opening laterally into the main framing. Thus the main shaft is removable laterally by taking off the main bearing caps. Such a method of construction, while eminently convenient, renders necessary a sound connection between the caps and the frame, otherwise the engine frame must be made too much like the jaws of a shearing machine. Such a connection does not appear, however, to be provided in the engine illustrated.

The Buckeye Company have adopted a peculiar double piston valve, which consists of an outer valve that works in a shell or seating forced into the valve chamber casting in a manner identical with that employed by a well-known Lancashire firm this 40 years or more. This main valve, of which there is one to each end of the cylinder, exhausts over its outer ends, and admits steam by ports cut through its body, these ports being controlled by an inner piston which acts as a cut-off valve, on the lines of the Meyer double slide. The whole device is a combination of the old English form of piston valve with a still older cut-off, that was employed in Lancashire in conjunction with the old **D** valve, the only difference being, that the cut-off valve in the old **D** was, of course, flat. This Buckeye valve should prove good, but it might have been simplified by rejecting the inner piston and giving to the one piston valve the partial rotation for cut-off that distinguished its English prototype.

For the bedplate of the Reynolds-Corliss engine much is claimed. It consists of a whole-framed bed to carry the main bearing, with a raised end or hood to attach to the bored guide-piece that connects the hood to the cylinder. If good design is beautiful, this design must be far from good, for it is ugly to a degree, though it probably lends itself to economy in the workshop. Mention is made of Rockwood's compound engines, which rival triple-expansion engines in economy, operating with 25 to 35 expansions, and being thoroughly jacketted and fitted with liberal re-heaters. They use steam at 160 to 180 lbs. pressure, have a cylinder ratio of about 1 to 7, and use 12 lbs. of *dry* steam per I.H.P.-hour.

Probably Mr. Rockwood looks after the *drying* very well, and is alive to the fact that compounding in every degree, even to the sublime third, is only one way of combatting cylinder effects, which, if abolished, would seem to call on us to abolish our faith in compounding.

A pumping engine constructed by the Nordberg Company, of Milwaukee, has developed 162 foot-pounds of work (? indicated) from 1 British thermal unit. This engine is vertical, of the quadruple expansion type, and has receivers and re-heaters after each of the first three cylinders, as well as jackets; it has also a series feed-heater, each section of which receives steam successively from one of the intermediate receivers. The result is a feed at 311° F., and an approximation to a Carnot cycle of events.

THE SYNCHRONISATION OF ALTERNATORS COUPLED IN PARALLEL.

[Condensed translation of the second and third parts of a paper entitled "A Study of the Transmission and Distribution of Energy by Alternating Currents," read before the Société Internationale des Electriciens by M. Maurice Leblanc.]

(*Continued from page* 581.)

Modification in the Method of Construction of Induction Machines.

The secondary circuits of the induction machine can no longer be closed on themselves, but must be connected with the external apparatus, capable of furnishing the E.M.Fs. necessary to ensure the apparent diminution of the coefficient of self-induction. Although that brings no serious complication, as we have attached great importance to the fact that the secondary circuits of induction machines, being closed on themselves, dispense with movable contacts, it appears to us useful to describe forthwith an arrangement allowing of both the primary and secondary circuits being fixed, and in which only intermediary circuits, closed on themselves, will be movable.

This arrangement is represented in figs. 9, 10, and 11. It requires the employment of two distinct machines, A A, B B, assembled on one base, around the same axis, O O (see fig. 2). Fig. 9 represents two half-sections made by a plane normal to the axis, one through machine A A, the other through machine B B.

The machine, A A, is composed of:—

1. A crown of fixed iron plates, C C, carrying the primary winding of a single-phase induction machine. We have supposed this

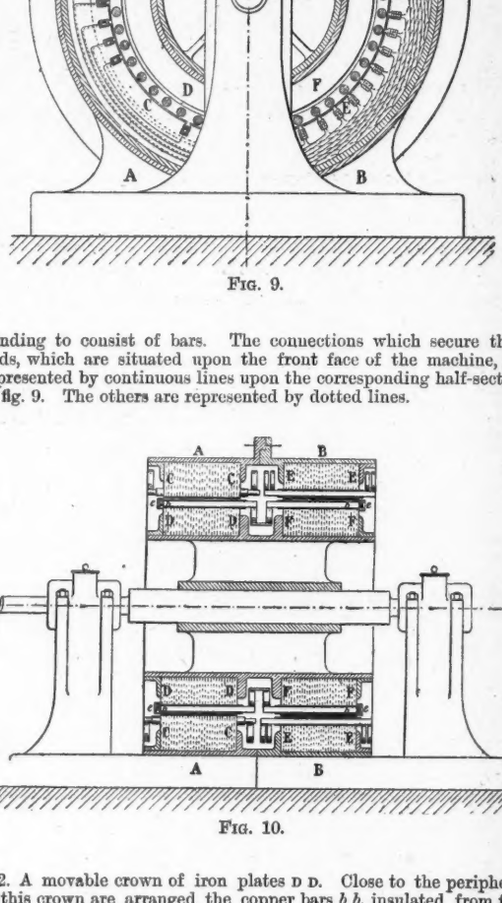


Fig. 9.

winding to consist of bars. The connections which secure their ends, which are situated upon the front face of the machine, are represented by continuous lines upon the corresponding half-section of fig. 9. The others are represented by dotted lines.

Fig. 10.

2. A movable crown of iron plates D D. Close to the periphery of this crown are arranged the copper bars *b b*, insulated from the iron and regularly placed around the axis of the machine. The ends of these bars turned towards the outside of the system are

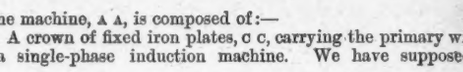


Fig. 11.

secured electrically and mechanically by a circle of copper, *c c*, into which they are fitted. Their other extremities will be individually secured to the ends of the bars belonging to the movable crown of the machine B B, as will be explained later.

The machine, B B, is composed of:—

1. A crown of fixed iron plates, E E, carrying either several

identical circuits regularly displaced with reference to each other or an armature winding like that of continuous current machines. This winding may still consist of bars arranged in a circle, as represented in figs. 9 and 10.

2. A movable crown of iron plates F F. The circuits carried by this crown are formed and arranged like those of the crown D D. In particular the numbers of bars of which each is composed are equal.

The connections between the ends, which are turned towards the interior of the machine, of the bars belonging to the two movable crowns, D D and F F, are made in the following manner:—

Suppose in order to fix our ideas that the windings of the fixed crowns, C C and E E, are for four poles, and that the movable crowns are each furnished with 48 bars, as represented on figs. 9 and 10.

Consider the free ends of 24 consecutive bars belonging to the crown D D, and the free ends of 24 consecutive bars belonging to the crown F F.

Upon fig. 11 we number the ends of the bars of the crown D D, 1, 2, 3—24, and the ends of the bars of the crown F F, 1′, 2′, 3′—24′. We connect, as we see on that figure,

the free end of bar	1	to that of bar			24′
„	„	2	„	„	23′
„	„	3	„	„	22′
...	...	...	...	...	...
„	„	24	„	„	1′

In this manner if the bars 1, 2, 3—24 are traversed by alternating currents of the same frequency, but whose strengths may be successively displaced by $\frac{1}{24}$ of a period, the currents which traverse the bars 1′, 2′, 3′—24′ will present differences of phase succeeding in inverse order.

It follows that if the first currents develop a field turning in a certain direction with reference to the surface of the crown D D, the second will develop a field turning in the opposite direction with reference to the surface of the crown F F.

Under these conditions the circuits of the crown C C, will serve for the primary of the machine A A, and the circuits of the crown D D, for its secondary circuits. These instead of being closed on themselves will deliver alternating currents in the circuits of the movable crown F F. These circuits (F F) will serve as the primaries to the machine B B, whose secondary circuits will be formed by those of the crown E E.

Our generator will thus be formed by the union, upon one base, and around the same axis, of two induction machines mounted "in cascade."

Such a machine requires, for the same frequency of currents generated, a speed only half that of an ordinary machine; that is to say, that with the same tangential speed we shall be able to give a development twice as great to each of its elements, which is a considerable advantage in itself

But the principles upon which such a machine operates being identical with those of an ordinary machine furnished with rings and brushes for collecting or delivering the current, and these last being more easily represented, we shall suppose, in what follows, that we have always to deal with them.

Methods of Artificially Diminishing the Coefficients of Self-induction of the Secondary Circuits of an Induction Machine.

It is known that a condenser, placed in a circuit traversed by an alternating current causes an apparent diminution of the coefficient of self-induction of that circuit.

The apparent energy that a given condenser can absorb is proportional to the frequency of the currents which traverse it. Consequently, by making use of these apparatus, we lose all the advantage resulting from the diminution of the apparent energy necessary for the excitation of our generators, obtained by exciting them with the currents of lower frequency which traverse the induced circuits of these machines.

It is not the same if we use condensers of the electrolytic type; we may consider these last as ordinary condensers, of enormous capacity, which break down when the effective voltage maintained between their terminals exceeds 1·4 volts, but are all able to spontaneously reconstruct themselves. But if their capacity is very great, or rather, the quantity of energy that they are able to store with a given volume and weight, their resistance is very great also, while that of ordinary condensers is negligible.

The efficiency of these apparatus increases when they are traversed by currents of lower frequency. They are quite useless when we wish to use them, for example, to split single-phase currents of the usual frequency, but are very convenient in our case, where we are dealing with currents of only one quarter the frequency.

It is sufficient, in order to make good use of them, for them to be traversed by currents whose density does not exceed that of currents charging accumulators. Under these conditions they do not heat, notwithstanding continued usage, and they give a good return.

(To be concluded.)

THE NICLAUSSE WATER-TUBE BOILER.

We have recently had a good deal to say on water-tube boilers in the Navy, with special reference to the Belleville boiler, the principles of which we have steadily and persistently denounced as inimical to the safety of the British Empire. Though the Niclausse boiler is also of French origin, and is not calculated to produce smokeless combustion of bituminous coal, we can at least admit that its tubular construction and arrangements are safe. Its tubes are constructed on the principle of the Field tube, that is, with an outer tube with one end closed and the other delivering into a chamber, and containing an inner tube fed at its other end from another chamber, and delivering at its lower end near to the closed end of the outer tubes. The tubes are inclined, and there is thus afforded a free entry of water to the tubes, and a free delivery from them into an uptake chamber. The two currents are separated, and there is a reasonable expectation that circulation will establish itself and vigorously continue. Thus the Niclausse boiler should be safe, though we fear it must inevitably be smoky as arranged, in spite of the lining of the furnace sides with brick.

In the development of the boiler the tendency has been towards a reduction in the size of the tubes. Originally they were made with tubes of 4 inches (actually 100 mm.), while marine boilers were made with 3¼-inch tubes (82 mm.). The larger tubes have now been given up, and the smaller size substituted, with great improvement in the facility of handling and removal. In small warships the tubes are only 40 mm., and this is the size in the French torpedo cruiser, *Fleurus*, a vessel of 4,000 H.P., and in the *Téméraire*, of 1,500 H.P., a trial from this type showing a combustion of about 82 lbs. per square foot for as much as 10 hours at a time. The peculiarity of the boiler is the method of fixing the tubes. They are not expanded nor are they screwed in, but are coned and pushed into coned holes, the tube being thus coned into both front and back plates of the headers, while the internal tubes are held in the back plate and supported freely in a central plate that divides the header chamber into up and down-comer sections. The outer tube is cut away where it passes through the up-comer, and the inner tubes are cut away in the down-comer so as to afford ingress and egress respectively.

All tubes are identical, and all joints metal to metal, and it is claimed that repairs are easily made, so that a tube is said to be removed in 90 seconds and a whole section may be changed in 30 minutes.

The steam drum extends across the boiler, and the headers connect into it below, so that the up and down-comers are drowned, but there are extension cones to keep the inlet and outlet openings apart, or other means are taken to give this effect. There have been several vessels of the French Navy fitted with the boiler, and some of the Spanish ships were so fitted. A trial was intended of one in the British Navy, and the *Seagull* is supplied with the boiler, but no proper trials have, we believe, been made. If the Belleville boiler owes its adoption to Mr. Goschen, we may hope that it will disappear with him, and that the future of our navy may be in the hands of those who will adopt no boiler that has not been proved successful. We say this with a full recollection of the great and glorious tests of the *Powerful* and *Terrible*, and also in view of their sequel in the utter condemnation of the *Europa*.

THE COMPULSORY SUPPLY OF ELECTRICITY.

The legal liability to supply electricity to all comers within their district (this being the consideration "paid" to the public by all electric supplies companies in return for Parliamentary powers), is formulated in Sec. 27 of the Electric Lighting (Clauses Act), 1899.

Sub-Sec. (1) of that section provides that the undertakers shall furnish an adequate supply to every consumer within 50 yards of a distributing main of the undertakers in which they are required to maintain, or are maintaining, a supply of energy for the purposes of general supply. The necessary lines, &c., must be laid by the undertakers, subject to the following conditions:—(1) The cost of all electric lines laid on the premises of the consumer, and (2) the cost of so much of such connecting lines as it may be necessary to lay for a greater distance than 60 feet, are to be borne by the consumer, if the undertakers so require.

It should be remembered that there are two kinds of mains through which electricity may be supplied by undertakers; (1) those mains which must be laid in accordance with the special order within two years of its commencement [See Sec. 21, Sub-Sec. (1) of 62 & 63 V., c. 19], and (2) those which may be laid at the requisition of owners and occupiers in accordance with Sec. 24 (1) of the Act. The supply of electricity through all such mains to the premises of any consumer is apparently compulsory.

According to the "Regulations for Ensuring a Proper and Sufficient Supply of Electrical Energy," published by the Board of Trade in 1895, "No change shall be made in the pressure of the supply to any premises which at the date of these regulations are supplied with energy by the undertakers except with the consent of the consumer."

Each owner or occupier requiring a supply of electricity must (by Sec. 27 (2)), (*a*) serve a notice upon the undertakers specifying the premises to be supplied, the amount required, and the date upon which the supply is to commence; (*b*) if required contract to receive and pay for a supply of energy for a period of at least two years of such an amount that the payment to be made shall not be less than 20 per cent. per annum on the outlay incurred by the

undertakers in providing electric connecting lines in accordance with this section; (*c*) if required, give security for the payment to the undertakers of *all monies* which may become due to them in respect of lines and energy.

The outlay incurred by the undertakers in providing electric lines will not often be large, seeing that the mains usually run along the street, and the whole expense of laying connecting wires on his own land falls on the consumer. The giving of security ensures continued payment to the undertakers should the premises come into other hands.

A further provision with regard to the giving of security may be found in Sub-Sec. (3), which provides that the undertakers may *at any time*, by giving seven days' notice, require the owner or occupier to give security for monies due and to become due.

It is useful to notice that incoming tenants are not liable to pay arrears of rents unless they have expressly undertaken to be so liable. Thus, by Sec. 39 of 34 and 35 Vict., c. 41:—"In case any consumer of *gas* supplied by the undertakers leaves the premises where such gas has been supplied to him, without paying the gas rent or meter rent due from him, the undertakers shall not be entitled to require from the next tenant of such premises the payment of the arrears left unpaid by the former tenant, unless such incoming tenant has undertaken with the former tenant to pay or exonerate him from the payment of such arrears."

A question sometimes arises whether the owner or occupier of the house in question is properly chargeable with the rent. In the case of Westminster Electric Supply Corporation *v.* McCall and Macintosh [Electrical Review, July 30th, 1897, p. 151], the company had arranged to supply current to McCall. He paid his account from time to time in the ordinary way, and then sublet to Macintosh, during whose tenancy the company was unable to obtain any payment. Eventually, and as the result of an action brought by the company against McCall and Macintosh, his Honour Judge Lumley Smith decided in favour of the company, holding Macintosh, the sub-tenant, liable to pay for the supply and all the costs of proceedings.

The owner or occupier must not use any form of lamp or burner, or the energy supplied in such a manner as to interfere unduly or improperly with the efficient supply of energy to any other body or person by the undertakers. If he does so, the undertakers may discontinue to supply energy to his premises. [See Sub-Sec. 4., Sec. 27.]

The above provision must be qualified by reference to Sec. 18 of the Act of 1882, which provides that undertakers shall not be entitled to prescribe any special form of lamp or burner to be used by any company or person, or in any way control or interfere with the manner in which electricity supplied by them is used.

Undertakers need not supply energy unless they are reasonably satisfied that the electric lines, &c., therein are in good order and not calculated to afflict injuriously the supply to other persons [Sub-Sec. 5.]

All differences arising under the section are to be determined by arbitration.

The maximum power which may be demanded by a consumer is defined very literally in Sec. 28 of the Act. Should the consumer desire any alteration in that maximum, he must give one month's notice to the undertakers and bear the expense of all alterations himself. Differences between the undertakers and occupiers as to what constitutes "reasonable consumption on the premises" are to be determined by arbitration.

The supply of electricity to public lamps is provided for in Sec. 29. All lamps within 75 yards from any distributing main of the undertakers must be supplied with such quantities as the local authority may require to be supplied. Default in supplying electricity to public lamps involves the payment of a penalty not exceeding 40s. for each lamp, and for each day on which the default occurs (Sec. 30, 1).

Penalties for Failure to Supply.

When undertakers make default in supplying energy to any owner or occupier of premises to whom they are under obligation to supply energy, they become liable to a daily penalty not exceeding 40s. (Sec. 30, 1).

The penalty is here incurred by improperly cutting off or discontinuing the supply of electricity [Commercial Gas Company *v.* Scott, 44 L.J. 171; 10 L.R.Q.B. 400; 32 L.T. 765; 23 W.R. 874]. It would seem from this case that the undertakers are liable to penalties (*a*) if they refuse to supply electricity at all; (*b*) if they refuse to supply it at a particular pressure. Save possibly by indictment, there is no other remedy open to the consumer. He cannot bring an action against the company (see Clegg *v.* Earby Gas Company (1896) 1 Q. B. 592; 65 L. J. Q. B. 339], where Wills, J., said at p. 594 "In my opinion this is one of those cases where the principle applies, that, where a duty is created by statute which affects the public as the public, the proper remedy if the duty is not performed is to indict or take the proceedings provided by the statute." [See also Sheffield Waterworks Company *v.* Wilkinson and Corbidge, 43 J. P. 703.]

If the undertakers make default in supplying energy in accordance with the Board of Trade regulations, they are liable to the penalties thereby inflicted [Sub-Sec. 3].

The penalties referred to here are those contained in R. 8 of the Board of Trade Regulations, 1895.

Penalties inflicted in accordance with this section are not to exceed in the aggregate £50 a day unless the undertakers have been guilty of wilful default. No penalty is inflicted if the Court are of opinion that the default was due to inevitable accident *force majeure*, or was of a slight or unimportant character. [See Sub-Sec. 4.]

As to what constitutes inevitable accident, reference may be made to the Irish case of the Sun Insurance Company *v.* The Corporation of Dublin (noted in the Electrical Review, December 9th, 1898, p. 859). There the breakdown was due to a defective cable, which, when laid down, was the best known to the trade. It had given satisfaction for four years when it was discovered that, owing to some unaccountable chemical action, the rubber was destroyed. The magistrate accepted the engineer's evidence that the failure was due to unavoidable accident, and dismissed the summons without costs.

The expression *force majeure* is equivalent to the Act of God. For the purpose of limiting the liability of a common carrier, this term has been defined to mean not merely an accidental circumstance, but something overwhelming (Oakley *v.* Portsmouth, &c., Steam Packet Company, 11 Exch. 623; 25 L. J., Ex. 101, per Martin, B.), which could not happen by the intervention of man, as storms, lightning and tempests. (Forward *v.* Pittard, 1 T. R. 33 *per cur.*), and which "could not have been prevented by any amount of foresight and pains and care reasonably to be expected from" the carrier. [Nugent *v.* Smith, 1 C. P. D. 441.]

THE UNIONS OF STATE EMPLOYÉS.

Speaking at a General Committee meeting of the London branch of the Postal Telegraph Clerks' Association, Mr. C. H. Garland said he wished to speak on a most important topic. There was no more interesting figure in the modern political arena than M. Millerand, the French Minister of Commerce, Industry, Posts and Telegraphs. A socialist, and the author of the famous St. Mandé programme, he spoke as the voice of the French intellectuals. Naturally his advent to the Ministry was watched with interest by all State employés. Speaking on October 7th, he had told the miners in Lens his views on the utility and functions of trades unions. There was, he said, an epoch when even the community of suffering was denied to the proletariat. But in 1864 the Empire, in the foolish hope of making the workmen forget that political liberty was the first necessary condition of all other liberties, granted them the right to combine and struggle. This was a sacred right, upon which no Government would dare to lay its hand, for it was the supreme recourse of the worker in his need. But how dangerous was the exercise of this right. Master and workmen alike suffered, and victory was dearly won in all cases. When all good spirits were occupied in securing peace between different nations, how wise and logical it would be to devise means of preventing war between children of the same nation. He looked to arbitration to effect this, and personally leaned towards compulsory arbitration. But arbitration presupposed organised corporations of the workers, which could depute representatives, and contract in the name of the corporation. He had on all occasions, and by every means at his disposal, urged the workers to organise. He had been accused of organising social war on the one hand, and of sacrificing his principles on the other. Neither was true. He believed wage service to be no more eternal than was slavery, and believed that property must assume a social form. But it was neither by the way of violence nor of hate that the proletariat would reach emancipation. He would conquer by making himself each day more capable, by disciplining himself, by raising himself. He would conquer by incessant and laborious effort. It was the duty, the true *rôle* of Government to aid to its utmost this beneficent evolution. He would neglect nothing that would smooth the way of the worker on the pacific and fruitful route of their emancipation. In a subsequent interview with him (Mr. Garland), M. Millerand said that he believed that the amelioration of the conditions of State employés, like that of other workers, depended mainly on themselves, and the work and functions of unions would play a large part in the working out of their salvation. In England trade unions were so well known and understood that no difficulty existed in the way of the formation of unions of State employés. In France, however, the state of public opinion was not nearly so advanced, and unions, even outside the State, were not so well understood. He thought, therefore, that the time was not yet ripe for such unions, but believed they would serve a useful purpose when the condition of public opinion permitted of their formation. He believed that such a state of public opinion was beginning, and the French were becoming accustomed to the idea of State employés' unions through the existence of unions among the employés of the State tobacco and match factories. The postmen were even now forming a trades union, and no interference had taken place. He believed the use of their votes by the employés of the State as a means of obtaining ameliorations in their conditions, was a legitimate use. He thought some distinction should be made between the civil rights of a State employé and the employés of private firms; but, although he believed in the nationalisation of industries, he ventured no opinion on the civil deprivation that would result to the workmen in the various industries. He thought that by the time the State was the universal master, there would be no need for unions or the exercise of civil rights to obtain ameliorations. He gave no opinion on the suggestion that during the transitional period it would be well to give this safeguard to the workmen. The Union of Postmen referred to by M. Millerand was a true trade union, whose functions were the promotion of economic measures in favour of the members of the Union. It proposed that the executive of the Union should act as intermediary between the minister and his staff and the postmen, and one of its rules gave power to the Union to give monetary assistance to the members of other trades unions on strike. The Union would severely test the disputed right of combination among the French postal staff.

OUR LEGAL QUERY COLUMN.

[Questions addressed to the Editors for insertion in this column should be as brief and concise as possible. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.]

No. 27.

"Electrical Engineer" writes: "In this district considerable damage has been occasioned by the sinking of the ground beneath the highways, owing to mining operations. Electric and other mains are seriously interfered with, and in some cases actually broken, by the withdrawal of support. I shall be glad to have the opinion of your legal correspondent as to whether the company which owns the electric mains in question have any, and if so, what right of action against the mine owners."

*** The somewhat novel query put forward by "Electrical Engineer" is one which must affect large districts in the North of England. It was decided in the case of Normanton Gas Company *v.* Pope (52 L.J., Q.B. 629; 49 L.T. 798) that owners of minerals under gas pipes are bound to give them proper support, but, on the other hand, are entitled to compensation under the Gas Acts for the limitation of use thereby imposed upon them. The same principle was applied to electric lighting mains by the Act of 1882, Section 38 of which provides that:—"Nothing in this Act shall limit or interfere with the rights of any owner, lessee, or occupier of any mines or minerals lying under or adjacent to any road along or across which any electric line shall be laid to work such mines and minerals." On the same principle, owners of mines would be entitled to compensation for any such support that might be required for electric lines under Section 17 of the Electric Lighting Act of 1882.

The above opinion is based upon the assumption that the company in question are not the highway authority. If they are, they have a remedy for damage done to the highway. This right is preserved by Section 47 of the Highways and Locomotives Act, 1878 [see Attorney-General *v.* Conduit Colliery Company (1895), 1 Q.B. 301; 59 J.P. 70].

No. 28.

"Seth Thomas" writes:—"A joint stock company is formed with an authorised capital of a certain amount, part of the stock being subscribed for and being either wholly or in part paid up. An issue of debentures is contemplated, which together with the subscribed stock is not as large as the authorised capital. Have special powers to be obtained for the issue of the debentures?"

*** "Seth Thomas" appears to assume that the amount of debentures which a company can issue has some relation to its authorised capital. The issue of debentures by a company depends upon the powers conferred by the memorandum of association. "There is no doubt," said Lord Selborne, "that where there is not an express prohibition against borrowing in a case of a company or a society constituted for special purposes, no borrowing can be permitted without express authority unless it be properly incident to the course and conduct of the business for its proper purposes" [Blackburn Soc. *v.* Brooks, 22 Ch. D. 61, 70]. To put it shortly, a company may, subject to the restrictions in its articles, borrow all such sums as it may require. There is no limit fixed by the Companies Act as to the extent of the borrowing powers of a company, nor are any directions given as to the manner in which those powers are to be exercised.

No. 29.

"Engineer" writes:—"I shall be glad if you will be kind enough to supply answers to the following legal queries: (1) Where a nominal 100-volt pressure is contracted for, what variation of force would be considered as constituting a breach of contract, and what remedy would be open to the person contracting to receive the supply? (2) Where it was understood that the current supply should be available during the 'usual lighting hours,' what exact interpretation should be given to the term 'usual lighting hours?' (3) Where the current is supplied by contract, and not by meter, and on the understanding that certain candle-power lamps only should be used, would the consumer be justified in changing his lamps for a lower voltage of the same candle-power, to correspond with the drop in pressure occurring on the supplying mains?"

*** In answer to the first question put by "Engineer," we would refer him to the Board of Trade Regulations for 1895. It is provided by Regulation B (7) as follows:—"The variation of pressure at any consumer's terminals shall not under any conditions of the supply which the consumer is entitled to receive exceed 4 per cent. from the declared constant pressure." The remedy is also provided by these regulations. Thus R. B (8) provides that if the undertakers make default in complying with any of these regulations as to supply, they shall, subject to the provisions of the order, be liable on conviction to a penalty not exceeding £5 for every default, and to a daily penalty not exceeding £5."

With regard to Question 2, the decision of the point seems to depend upon a variety of circumstances. Thus in London "usual lighting hours" would include the times when artificial light is rendered necessary by thick fog, and the time of sunrise and sunset would also be taken into consideration.

We might add that a contract based on usual lighting hours is unsatisfactory in the extreme.

3. So long as the lamp used by a consumer has no prejudicial effect upon the general supply, it seems that a consumer may employ any lamp he chooses. By Section 18 of the Electric Lighting Act, 1882, it is provided that the undertakers shall not be entitled to prescribe any special form of lamp or burner to be used by any company or person, or in any way to control or interfere with the manner in which electricity supplied by them under the Act and any license, order, or special Act, is used. *Provided always* that no local authority, company, or person shall be at liberty to use any form of lamp or burner, or to use the electricity supplied to them for any purposes, or to deal with it in any manner so as to unduly or improperly interfere with the supply of electricity supplied to any other local authority, company, or person by the undertakers, and if any dispute or difference arises between the undertakers and any local authority, company, or person entitled to be supplied with electricity under this Act, or any license, order, or special Act as to the matters aforesaid, such dispute or difference shall be determined by arbitration.

Provided he does not come within the four corners of the above section, we see no reason why "Engineer" should not use any form of lamp he may desire.

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS, 1900.

Compiled expressly for this Journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, Manchester, and Birmingham, to whom all inquiries should be addressed.

18,806. "Improvements in 'trolleys' and junction 'frogs' for use on electric railways and tramways." D. B. Foster, G. P. Gibson, and H. Foster. Dated October 22nd.

18,813. "Improvements in electric locomotives." B. Hopkinson. Dated October 22nd.

18,816. "Improved electrical indicator for use with alternating-current apparatus." C. L. Clarke. Dated October 22nd. (Complete.)

18,820. "Improvements in electric arc lamps." H. Bremer. Dated October 22nd.

18,834. "Improvements in voltmeters." N. Vasilesco-Karpen. Dated October 22nd.

18,855. "Improvements in connection with electrically driving machine tools or other mechanism." T. Humpage and Epicyclic Manufacturing Company, Limited. Dated October 22nd.

18,865. "Improvements in apparatus for the production of electrical oscillations." J. A. Fleming and Marconi's Wireless Telegraph Company, Limited. Dated October 22nd.

18,874. "A revolving centre-piece for two-storey electric cars." W. H. Dunn and E. Scott. Dated October 23rd.

18,889. "A new or improved electrically operated billiard marker." V. Hope. Dated October 23rd.

18,898. "Improvements in electric recording instruments for motor cars." P. Singer. Dated October 23rd.

18,904. "Improvements in or relating to thermo-electric batteries." W. J. Crawford and T. B. Turley. Dated October 23rd. (Complete.)

18,914. "Electric meters." T. A. Edison. Dated October 23rd. (Complete.)

18,921. "Improvements relating to electric furnaces." G. Benedicks. Dated October 23rd. (Complete.)

18,924. "Improvements in electric switches." W. H. Chipperfield and E. S. Cook. Dated October 23rd.

18,925. "Improvements in electric switches." W. H. Chipperfield and E. S. Cook. Dated October 23rd.

18,934. "Improvements relating to electric incandescent lamps." R. Trimmel. Dated October 23rd.

18,940. "Improved means for the electrical illumination of the dials of ships' telegraphs and for similar purposes." Eversheds & Vignoles, Limited, and S. Eversheds. Dated October 23rd.

18,967. "Improvements in electric incandescent lamps." R. B. Ransford. (A. W. W. Miller, United States.) Dated October 23rd. (Complete.)

18,975. "Thermo-electric generator." W. L. Wise. (M. J. Wightman, United States.) Dated October 23rd.

19,050. "An improved electric-circuit closing thermometer." F. Cosson. Dated October 24th.

19,058. "Improvements in electrical brakes for railway cars." F. C. Newell. (Date applied for under Patents, &c., Act, 1883, Section 103, March 28th, 1900, being date of application in United States.) Dated October 24th.

19,071. "Improvements in and relating to a magneto-electric generator with governing arrangements for ignition purposes on motor cars, stationary gas and oil engines, and other purposes." F. T. Reid and W. Shepherd. Dated October 25th.

19,072. "Improvements in electric accumulators." G. J. Gibbs. Dated October 25th.

19,076. "Improvements in or in connection with the means for electrically lighting miners' safety and similar lamps." J. C. Best. Dated October 25th.

19,095. "Improvements in or applicable to electric ceiling roses, electroliers and the like." C. W. Watling, Jun. Dated October 25th.

19,099. "An improved electrode for accumulators of electricity." J. Myers. Dated October 25th. (Complete.)

19,118. "Improvements in secondary electrical batteries, accumulators." P. Stiens. Dated October 25th.

19,119. "Improvements in or connected with the electro-deposition of metals or metallic alloys." G. E. Vaughan. (H. Koegel, Germany.) Dated October 25th.

19,150. "Improvements in electric light lampholders with shade carriers." A. H. McNaught. Dated October 26th.

19,151. "Improvements in trolley-heads for overhead conductors of electric railways." R. J. Urquhart and H. Goodwin. Dated October 26th.

19,163. "A frictionless balance for weighing gravitational electric and other forces." W. Thomson, Baron Kelvin of Largs. Dated October 26th.

19,167. "Improvements in and relating to electrical resistances variable by light, and certain other rays or waves, and in the manufacture of the same." J. T. Armstrong and E. A. Goddin. Dated October 26th.

19,183. "Improvements in and connected with electrical pushes and switches." E. G. Harcourt. Dated October 26th.

made to the Irish case of the Sun Insurance Company v. The Cor-

puted right of combination among the French postal staff.

19,213. "Improvements in dynamo-electric machines and motors, and in means for regulating the same." L. B. Atkinson. Dated October 26th.

19,220. "Improvements in unions or connections for electric light pedants and other fittings." H. Hirst and J. H. Collings. Dated October 26th.

19,228. "Improvements in or relating to electrical ignition devices for explosion engines." Z. Wirt. Dated October 26th.

19,227. "Aerial or wireless telephony." C. Adams-Randall. Dated October 27th.

19,238. "Improvements in or relating to machinery or apparatus for covering electric cables, wires and other cores." I. L. Berridge and B. Kerr. Dated October 27th.

19,251. "Improvements relating to arc lamps." A. De Puydt. Dated October 27th. (Complete.)

19,263. "Improvements in rheostats." L. Kamm. Dated October 27th.

19,280. "Improvements in electric arc lamps." The Jandus Arc Lamp and Electric Company, Limited, J. M. Gorham, and A. D. Jones. Dated October 27th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, Manchester, and Birmingham, price, post free, 9d. (in stamps).

1898.

26,829. "Improvements in current collectors for electric traction." E. Penning-Dupuis. Dated December 16th, 1898. Relates to electric railways and tramways on the overhead system. The bow or frame is built up of spring members and carries a series of contact rollers on a hollow perforated spindle containing lubricant. The rollers fit together with coned end bushes and intermediate ball bearings. 1 claim.

26,806. "Improvements in steam or electric after-steering gear for ships." W. B. Thompson. Dated December 20th, 1898. Relates to steam and electric steering gear placed at the stern of the vessel. On the rudder head is keyed a quadrant grooved to contain a toothed rack connected to the quadrant by springs. A pinion on a vertical shaft gears with the rack. On the shaft is also keyed a worm wheel in gear with a worm rotated by a steam engine as shown, or by an electric motor. The steam engine is controlled by a reversing-valve actuated by a bell crank. The horizontal shaft is rotated by a hand-wheel or by a chain on the pulley. It carries a worm in gear with a wheel on the shaft, and thus, when rotated, moves endwise to rock the bell crank and actuate the starting valve. 4 claims.

26,886. "Improved means for manufacturing metallic ribbon especially applicable for battery electrodes." The Porous Accumulator Company, Limited, and J. C. Nowell. Dated December 20th, 1898. Relates to the method described in Specification No. 30,427, A.D. 1897, for producing metal ribbons particularly adapted for making the plates of primary and secondary batteries, the ribbons being made by helically cutting a tube while it is revolving on a mandrel. This invention consists in the use of a lathe similar in action to a screw-cutting lathe for producing these helical ribbons. 6 claims.

26,930. "An automatic telephone exchange and means relating thereto." E. Preismann. Dated December 20th, 1898. Relates to an automatic telephone system in which each subscriber is provided with a contact board, at the central station, having contacts for all the other subscribers. Each board is provided with right and left handed screws, and driving arrangements for placing the movable contact over the required connection, after which the magnet at the top of the board is excited, thereby lowering the contact on to the contact The magnets are provided with escapements on their armatures so as to drive the screw shafts. The lowest magnet is first operated, and when the side magnet is operated, a switch automatically breaks the circuit of the lowest magnet, and places the top magnet in circuit. The top magnet operates a jointed parallelogram connected to the contact when that contact has reached the desired position. 4 claims.

27,053. "Improved overhead electrical wire holder." F. Foy. Dated December 22nd, 1898. Holders for overhead wires, such as are used in electric railways, tramways, &c., are constructed with hooked gripping-pieces which draw the wires so far out of the straight as to leave the lower edge of the gripping-piece in line with the wire. When two insulated sections of line are to be supported by one holder, the block and gripping pieces are each divided by an insulating layer. Cross-over holders are also described. 4 claims.

27,074. "Improvements in incandescent arc electric lamps." W. E. Irish. Dated December, 22nd, 1898. Two hollow carbons enclose loose rods of zirconia, thoria, magnesia, lime, or other refractory material which becomes a conductor at a high temperature. These rods are in contact permanently. When current is first supplied an arc is formed between the carbons and heats the refractory rods, so that these become conductive. The rods are afterwards kept incandescent by the current flowing through them, the arc ceasing. The rods may be round or flat, or of + section. One carbon may be solid, the opposed refractory rod abutting against its end. In a modification solid carbons are surrounded by a tube of the refractory material. 3 claims.

27,097. "Improvements in arc lamps." H. R. Othesen. Dated December 22nd, 1898. Relates to arc lamps. Carbons are carried by holders hung by links from pivots placed between two plates, so that the point of contact of the carbons remains in a fixed position relatively to the plates as the carbons shorten. The outer links are provided with weighted or spring-actuated arms. The carbons are separated to strike an arc by a plate of refractory material, such as kaolin or porcelain, supported by a vertically-movable rod which carries an armature and is lowered by a series electro-magnet when current is supplied to the lamp, in opposition to the action of weighted or spring-pressed levers. The arc renders the plate incandescent. 4 claims.

27,128. "Etheric steering apparatus for controlling from a distance the steering gear of ships, torpedoes and other floating bodies electrically." L. Varicas and C. J. Varicas. Dated December 23rd, 1898. Relates to wireless electrical means for steering ships and other vessels and torpedoes from the shore. The shore apparatus consists of a make-and-break cylinder rotated by clockwork, a battery, and a transmitter. The cylinder is composed of an insulating tube, the two having equi-angular intermeshing projections. One contact piece is movable along the cylinder to vary the relative lengths of the periods of make and break, and the other is stationary. The vessel's apparatus consists of a Marconi coherer in circuit with a battery and relay which makes the circuit through a decoherer and an electro-magnet actuating the valve of the steering cylinder. When the cylinder makes the circuit the armature is attracted and compressed air or other fluid is admitted to throw the rudder over in one direction. When the circuit is broken the armature is released and retracted by a spring to reverse the valve and throw the rudder over in the other direction When the periods of make and break are equal the rudder is put over equally in both directions, and as a result the vessel travels in a straight line, but by varying the relative lengths of make and break the vessel can be steered to either port or starboard. 4 claims.

27,268. "Improvements in connection with alternate current arc lamps and lanterns." W. M. Mordey and H. Bevis. Dated December 24th, 1898. Relates to arc lamps. In order to reduce the production of noise by an alternating current lamp of any construction it is completely enclosed, or any necessary airways are restricted and lengthened or muffled, and all parts liable to vibrate are supported, covered or lined with substances such as asbestos or rubber. Asbestos packing is placed between the globe and lamp frame and casing. A hand-regulated lamp, with or without an arc enclosing globe and cover, may be mounted in a box for stage lighting. The box is lined with sheet iron and asbestos, air spaces being left between the sides of the box and iron. The lamp is carried by a narrow plate which is adjustable along grooves in the top of the box. The box may be carried by horizontal pivots on a forked support, the vertical stem of which can be turned on a stand. 2 claims.

27,269. "Improvements in and connected with apparatus for measuring electricity." H. G. Kundelmann, C. E. Francois, and C. R. Louberg. Dated December 24th, 1898. Energy and quantity meters, periodically measuring and adding power or current, are actuated by special controlling currents sent through one supply main and the earth by a time switch, as described in Specification No. 24,883, A.D. 1897; this system is now extended to motor meters, and coin-freed switch meters, means for indicating the passage of excess current and registering the duration of such currents being also provided. Clocks may be driven by the periodic currents, although the period may be changed so as charge different rates during different hours of the day. A motor meter for use on such a system has its counting gear pivoted and held against a stop by a spring, so that it is normally out of gear with the ordinary worm on the motor spindle. The counter carries an armature, and is attracted by an electro-magnet so as to gear with the spindle while the controlling current may be changed when a different rate is to be charged. 5 claims.

27,320. "Improvements in and relating to electric motors and method of controlling same." S. Y. Heebner. Dated December 27th 1898. According to this system of control, the motor is started as a two-pole machine, with all its field coils in series with each other, and is subsequently changed to a multipolar machine with all its field coils in parallel, the armature resistance being in the meantime reduced and the number of its poles increased. A two-pole machine can be formed by using two opposite coils, or by so connecting the coils that two of them give a common North pole and the other two a common South pole, while a four-pole machine is formed by reversing the connections of two of the coils. The armature is furnished with two windings connected to separate commutators, each of which is provided with four brushes. At starting, the four field coils and the two armature windings are all connected in series; secondly, two of the field coils are put in parallel, and the other two also in parallel, the first pair being in series with the second; thirdly, one of the armature windings is cut out; fourthly, the two armature windings are connected in parallel with each other; fifthly, one pair of the field coils is reversed, the two parts of the armature are put in series with each other, and the four brushes on each commutator are brought into action, when the motor works as a four-pole machine. At the sixth step, the two parts of the field are changed from series to parallel; at the seventh, one-half of the armature is cut-out; and at the eighth and last step, the two halves of the armature are connected in parallel. No external resistance is employed for controlling the speed. 8 claims.

27,334. "Improvements in telephone receivers." P. M. Justice. (A. T. Nye.) Dated December 27th 1898 Magneto receivers are arranged with the magnets set in a screw collar by means of the block and clamping-screw. The screw-collar engages for adjustment with the screw thimble and has screws arranged to bear on the thimble flange. The magnet does not come in contact with the case at any point. 2 claims.

27,335. "Improvements in telephone transmitters." P. M. Justice. (A. T. Nye.) Dated December 27th, 1898. A microphone is built up with one electrode attached to the diaphragm and having rotatably secured thereto the casing for containing the carbon granules. The second electrode is fixed in a bracket carried by the casing, and has a washer closing the cavity for the carbon. The casing has the cavity eccentric, so that, on rotation, the carbon granules move on each other to obviate packing. 2 claims.

27,336. "Improvements in apparatus for use in telephone exchanges." P. M. Justice. (A. T. Nye.) Dated December 27th, 1898. Relates to the arrangement of jacks and annunciators in telephone switchboards, by which the calling signal, such as a lighted lamp, is shunted and released on making the plug connection, but is free to act as a clearing out signal. The frame carries a plug socket and signal, such as a lamp on its face, and the electro-magnet jack springs on its back. The armature of the electro-magnet has a contact arm for closing the signal circuit and a release spring. When attracted the armature is held by a latch until the plug is inserted. The plug is provided with a recess which allows the annunciator to work while the plug is in position, and to be released by the withdrawal of the plug. The magnet is shunted by the plug circuit when the plug is inserted 4 claims.

27,370. "Improvements in the automatic regulation of monophase or polyphase alternators." R. B. Ransford. (Societe Sautter Harle et Cie.) Dated December 28th, 1898. Relates to the automatic regulation of monophase or polyphase alternators to constant potential. The application of the system to a three-phase alternator is described. The exciter is driven synchronously with the alternator, and its armature winding is supported by three conductors with alternating currents of comparatively low potential from a secondary circuit common to two transformers. The primary circuits of these transformers are in one case connected in series with the alternating-current mains, and in the other case across the mains. The exciter may be geared to the alternator, or it may be driven entirely by the alternating currents supplied to it. 2 claims.

27,390. "Improvements in coin-freed apparatus for electric and fluid meters." C. D. Abel (Societe Anonyme Continentale pour la Fabrication des Compteures a Gaz et Autre Appareils.) Dated December 28th, 1898. A horizontal fork jointed to a crank on the rock shaft of a switch, and resting upon a fixed pin is drawn so as to close the circuit when a disc having a recess to engage a pin on the lower arm of the fork, is turned after prepayment. Owing to a notch the fork hooks itself on the fixed pin, and frees itself from the disc, which is turned proportionately to the payment. A spring wound up to the same extent reverses the disc at a rate depending on the operation of an escapement anchor by the electric meter. Eventually a pin on the disc lifts the fork, and the circuit is opened by a spring acting on the crank. The coin in a pocket which is turned by a handle disengages a detent from a notched wheel and then turns it. 3 claims.

27,453. "Improvements in electric motors." H. Leitner. Dated December 29th, 1898. The field-magnets carried by the shaft are built up of iron laminæ, cut so as to present six poles, three of which are wound with insulated wire coils, the ends of which are connected through a bore in the shaft to two collecting rings. The armature is composed of iron laminæ, serrated inside and outside to receive the winding, and held between two side frames connected together by bolts and supported by ball bearings on the shaft. The armature winding is connected in the ordinary manner to a commutator, upon which bear brushes carried by holders fixed to the shaft, and electrically connected to a second pair of collecting rings. Either the field magnets or the armature may be made to revolve, or both may revolve in opposite directions. According to the provisional specification the motors are particularly adapted to the propulsion of vehicles. 1 claim.

27,526. "Improvements in thermo-electrical building bricks or blocks." J. Matthias. Dated December 30th, 1898. Bricks, archstones, flagstones, and the like for the walls of houses exposed to the sun, the ceilings of workshops heated by gas, &c., are made hollow and fitted with thermo-electric elements. The bottom of the brick exposed to the heat is completely closed by the elements, which are formed into points at their other ends. Each pair is insulated from the next by portions of the brick itself or otherwise, and the points are connected by metal bands, while one pair of diagonally opposite corner elements has terminals carried through the bricks and joined to those of the next. The points are in through passages which, when the bricks are laid together, form continuous passages. A current of cold air is drawn through these passages to cool the points of the elements. 2 claims.

27,586. "Improved direct-coupled driving arrangement for electric automotors." E. Egger. Dated December 31st, 1898. The field or frame of the electro-motor is attached to the fixed wheel axle or to the frame of the vehicle, and the armature is connected with the wheel or *vice versa*. A band brake drum may also be attached to the wheel hub. 2 claims.

27,593. "Improvements in systems of train control for electrically-propelled vehicles." The British Thomson-Houston Company, Limited. (F. E. Case.) Dated December 31st, 1898. Relates to those systems of train control in which master controllers are used, and the present invention consists in the use of a single separable controller which may be transferred to any part of the train and put in connection with the control system by connection boards or couplings, which thus replace a number of controllers. This system may be used with other than master controllers. These connection boards also serve for electrically coupling the carriages on the train. 9 claims.